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FINAL PLAN AND

CATALOGING - PREP FINAL ENVIRONMENTAL IMPACT STATEMENT

BUSH RIVER WATERSHED

PRINCE EDWARD COUNTY, VIRGINIA



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



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FINAL PLAN
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT
BUSH RIVER WATERSHED
PRINCE EDWARD COUNTY, VIRGINIA

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended, and in accordance with the National Environmental Policy Act (Public Law 190, 91st Congress, 83 Stat. 853, section 102(2)(C)).

Prepared by:

Piedmont Soil and Water Conservation District
Prince Edward County Board of Supervisors
Virginia Commission of Game and Inland Fisheries
Forest Service and Soil Conservation Service of the
U.S. Department of Agriculture
Virginia Division of Forestry

April 1976

45214

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PART I

FINAL PLAN

BUSH RIVER WATERSHED

PRINCE EDWARD COUNTY, VIRGINIA

WATERSHED PLAN AGREEMENT

between the

Piedmont Soil and Water Conservation District
Prince Edward County Board of Supervisors
Virginia Commission of Game and Inland Fisheries

(hereinafter referred to as the Sponsoring Local Organization)

State of Virginia

and the

Soil Conservation Service
United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Bush River Watershed, State of Virginia, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Bush River Watershed, State of Virginia, hereinafter referred to as the watershed plan, of which this agreement is a part;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed plan, and further agree that the works of improvement as set forth in said plan can be installed in about seven (7) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed plan:

1. The Virginia Commission of Game and Inland Fisheries has secured the landrights for the construction of structure 1E. Prince Edward County will acquire, with other than P.L. 566 funds, such landrights as will be needed in connection with the construction of multiple-purpose structure 12. The Piedmont Soil and Water Conservation District will acquire such landrights as will be needed for all other structural measures. Landrights costs are estimated to be \$1,333,500.

2. The sponsoring local organization responsible for securing landrights for each structure assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the responsible sponsoring local organization and the Service as follows:

	Prince Edward County (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation			<u>1/</u>
Payments	54.7	45.3	0

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. Prince Edward County will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Prince Edward County (percent)	Va. Comm. of Game and In- land Fisheries (percent)	Service (percent)	Estimated Construction Cost (dollars)
Floodwater Retarding Structures 2, 3, 4B, 5, 6, and 7	0	0	100.0	828,100
Multiple-Purpose Structure 12	50.1	0	49.9	1,486,000
Raw Water Intake	100.0	0	0	23,100

<u>Works of Improvement</u>	<u>Prince Edward County</u> (percent)	<u>Va. Comm. of Game and In-land Fisheries</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Multiple-Purpose Structure 1E	0	31.3	68.7	1,069,400
Fish and Wildlife Facilities	0	50.0	50.0	211,800
Additional Access Roads	0	100.0 ^{1/}	0	31,700

^{1/} To be constructed by the Virginia Department of Highways and Transportation.

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Prince Edward County</u> (percent)	<u>Va. Comm. of Game and In-land Fisheries</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Costs</u> (dollars)
Floodwater Retarding Structures 2, 3, 4B, 5, 6, and 7	0	0	100.0	88,600
Multiple-Purpose Structure 12	50.1	0	49.9	67,600
Raw Water Intake	100.0	0	0	3,800
Multiple-Purpose Structure 1E	0	0	100.0	48,700
Fish and Wildlife Facilities	0	50.0	50.0	14,830
Additional Access Roads	0	100.0 ^{1/}	0	2,220

^{1/} To be designed by the Virginia Department of Highways and Transportation.

6. The Sponsoring Local Organization and the Service will each bear the Project Administration costs which it incurs, estimated to be \$178,000 and \$302,000, respectively.

7. The Piedmont Soil and Water Conservation District will obtain agreements to carry out conservation plans from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure.

8. The Piedmont Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.

9. The Piedmont Soil and Water Conservation District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Virginia Commission of Game and Inland Fisheries will be responsible for the operation and maintenance of multiple-purpose structure 1E and the associated fish and wildlife facilities. Prince Edward County will be responsible for the operation and maintenance of multiple-purpose structure 12. The Piedmont Soil and Water Conservation District will be responsible for the operation and maintenance of all other structural works of improvement. The responsible sponsor will accomplish the operation and maintenance by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
13. The watershed plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.
14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Piedmont Soil and Water
Conservation District _____ By /s/ Robert C. Lanier
Local Organization _____

Farmville, Va. 23901 Title Chairman
Address _____ Zip Code _____
Date May 10, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Piedmont Soil and Water Conservation District (local organization) adopted at a meeting held on Oct. 15, 1975

/s/ Dudley L. Peery Farmville, Va. 23901
Secretary, Local Organization Address _____ Zip Code _____
Date May 10, 1976

Prince Edward County Board of
Supervisors _____ By /s/ John C. Steck
Local Organization _____

Farmville, Va. 23901 Title Chairman
Address _____ Zip Code _____
Date May 10, 1976

The signing of this agreement was authorized by a resolution of the governing body of Prince Edward County, Virginia (local organization) adopted at a meeting held on November 12, 1975

/s/ W. K. Manion Farmville, Va. 23901
~~xxxxxxx~~ Secretary, Local Organization Address _____ Zip Code _____
County Administrator _____
Date May 10, 1976

Virginia Commission of Game
and Inland Fisheries

By /s/ Chester F. Phelps

Local Organization
Box 11104

Richmond, Va.

23230

Title Executive Director

Address

Zip Code

Date May 10, 1976

The signing of this agreement was authorized by a resolution of the
Commission of Game and Inland Fisheries (local organization) adopted
at a meeting held on May 7, 1976

/s/ J. E. Moore

Office of Attorney General
Richmond, Virginia 23219

~~Secretary~~, Local Organization
Asst. Attorney General

Address

Zip Code

Date May 10, 1976

Appropriate and careful consideration has been given to the environ-
mental statement prepared for this project and to the environmental
aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

/s/ D. N. Grimwood

State Conservationist

May 10, 1976

Date

WATERSHED PLAN

BUSH RIVER WATERSHED

PRINCE EDWARD COUNTY, VIRGINIA

April 1976

SUMMARY OF PLAN

This plan was prepared by the Piedmont Soil and Water Conservation District, Prince Edward County, and the Virginia Commission of Game and Inland Fisheries, the sponsoring local organizations. Bush River Watershed project area, containing 98,772 acres, is located in Prince Edward County, Virginia.

The use and management of large areas of the flood plain lands of Bush River are severely limited because of the flood hazard. When not subject to flooding, these lands respond well to improved agricultural management practices and produce high yields of crops such as corn, hay, and small grain. They are also less subject to erosion than uplands. Other problems caused by flooding include damage to highways, public utilities, and farm improvements; erosion of the uplands; and sedimentation of the bottom lands. Orderly growth and planned development in the area is restricted by the lack of an adequate municipal water supply system, and because of a need for additional public fish and wildlife development. Average annual damages are estimated to be \$325,135.

These problems will be alleviated through the application of an overall watershed management plan. Acceleration of land treatment measures in addition to the going program throughout the project area and the installation of two multiple-purpose and six flood-water retarding structures will reduce average annual damages about 62 percent and provide 10,000 acre-feet of municipal and industrial water storage for Prince Edward County and 12,254 acre-feet of storage for fish and wildlife development. The eight structures will also control the runoff from 63,905 acres or 64.7 percent of the watershed and store sediment and floodwater.

Conservation plans and multiple use forest management plans will be developed and land treatment measures will be installed on approximately 2,811 acres of cropland, 3,714 acres of pastureland, 12,450 acres of forest land, and 835 acres of land in other uses. Wildlife upland habitat management on 175 acres will be included in the conservation plans as part of the planned land treatment measures. The district will assign priority to requests for technical assistance in installing land treatment measures in the watershed.

Land use adjustments on the flood plain and other management practices, made possible by the project, will provide greater profit margins for farm operations. Therefore, the people affected will have the opportunity to improve their standard of living.

Opportunities for urban development will improve with the establishment of an adequate public water supply and distribution system. Public access to the Briery Creek and Sandy River sites (1E and 12 respectively) will provide fishing and recreational opportunities for an estimated 159,100 visits annually.

It is estimated that the project can be installed in 7 years at a total cost of \$6,663,250. Public Law 566 funds will provide \$3,023,550 and other funds \$3,639,700 of this cost. Land treatment measures are estimated to cost \$973,900 with Public Law 566 funds providing \$137,300 for accelerated technical assistance, and other funds \$836,600 for installation cost and the technical assistance to continue the going programs. The estimated installation cost of the eight dams is \$5,689,350 with Public Law 566 funds bearing \$2,886,250 and other funds \$2,803,100. Of the amount supplied from other funds, \$1,333,500 will be used to acquire landrights; \$809,450 will pay for engineering services and construction that will provide 10,000 acre-feet of municipal water storage in structure 12; \$482,150 to pay for storage and fish and wildlife facilities associated with structure 1E; and \$178,000 for project administration.

In recent years the landowners and operators have installed land treatment measures at an estimated cost of \$394,200 in addition to the measures proposed in this plan.

The Piedmont Soil and Water Conservation District will coordinate installation of this project. Land treatment measures will be installed by owners and operators within the watershed through conservation plans developed in cooperation with the district. The Soil Conservation Service, and the Virginia Division of Forestry through cooperative programs with the U.S. Forest Service, will provide technical assistance as needed.

The Virginia Commission of Game and Inland Fisheries has purchased the land and will provide the non-federal share of the installation cost for the structure and associated fish and wildlife development for site 1E. Prince Edward County is in the process of purchasing the land needed for site 12 (70 percent complete) and will provide the non-federal share of the installation cost for this site. The Piedmont Soil and Water Conservation District has secured all of the necessary landrights on five of the six remaining sites. Investigation by the sponsors has revealed that no person, business, or farm operator will be displaced by the installation of the structures. If any relocations become necessary, Prince Edward County will meet all applicable requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

The Soil Conservation Service will provide the engineering services for structure 1E. The Virginia Commission of Game and Inland Fisheries have requested the Service to provide technical services, and to let and administer construction contracts for this multiple-purpose structure. The Virginia Commission of Game and Inland Fisheries will negotiate A&E contracts for surveys, investigations, design, and preparation of plans and specifications for the fish and wildlife features of multiple-purpose structure 1E. The Commission will also let and administer construction contracts for these facilities.

The Soil Conservation Service will negotiate A&E contracts with consultants for engineering services on structure 12. The Prince Edward County Board of Supervisors have requested the Service to let and administer construction contracts for this multiple-purpose structure. The county will provide inspection services deemed necessary to assure that the water supply features for structure 12 will meet contract requirements and function properly. The Piedmont Soil and Water Conservation District has requested the Soil Conservation Service to provide technical services and to let and administer contracts on structures 2, 3, 4B, 5, 6, and 7.

Prince Edward County will, at its expense, provide necessary access, parking, and sanitary facilities to allow use of site 12 for recreational purposes.

The Soil Conservation Service will provide construction inspection for all items on which P.L. 566 funds are spent and any other items of construction which may affect the function or stability of the structural works of improvement. The Soil Conservation Service will also provide the clerical, administrative, and related services that their activities require, and bear the cost it incurs.

Operation and maintenance of the dam and fish and wildlife facilities at site 1E will be performed by the Virginia Commission of Game and Inland Fisheries at an estimated average annual cost of \$78,860. Prince Edward County will operate and maintain structure 12 at an estimated average annual cost of \$2,000. Operation and maintenance of the other six dams will be performed by the District at an estimated average annual cost of \$3,900. Land treatment measures will be maintained by the landowners and operators through agreements with the Piedmont Soil and Water Conservation District.

Average annual benefits from all planned structural measures are estimated at \$749,550 (See tables 5 and 6). The average annual cost of structural measures is estimated at \$434,150, resulting in a benefit cost ratio of 1.7 to 1.0.

All information and data, except as otherwise noted, were collected during the watershed planning investigation conducted by the Soil Conservation Service and Forest Service, of the U.S. Department of Agriculture, and the Virginia Commission of Game and Inland Fisheries.

INTRODUCTION

This plan has been edited to avoid excessive duplication of information contained in the Environmental Impact Statement. Part II should be reviewed for additional information on project formulation, problems, alternatives, environmental impacts, and use of resources.

PLANNED MEASURES

The Bush River Watershed Plan proposes 142 conservation plans, 250 multiple use forest management plans, two multiple-purpose structures, and six floodwater retarding structures.

Conservation plans, prepared in cooperation with landowners, will include practices to improve vegetative land cover, reduce erosion, increase production and enhance fish and wildlife habitat. These practices will be applied on an estimated 2,811 acres of cropland, 3,714 acres of pastureland, and 835 acres of other land throughout the watershed. The Soil Conservation Service will provide the technical assistance needed to prepare the conservation plans and apply the conservation practices. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide the technical assistance needed to plan and apply woodland management practices on 12,450 acres.

Eight reservoir type structures will be installed. All will have floodwater retarding storage, one will have municipal and industrial water supply storage, and one will have additional storage for fish and wildlife purposes. Each of the structures will have a zoned type earth fill, a reinforced concrete principal spillway system, and a vegetated emergency spillway. The two multiple-purpose structures will also have structural emergency spillways. Water supply needs were established by consulting engineers. The Virginia State Water Control Board classifies Bush River as a "free flowing stream" with "waters generally satisfactory for use as public or municipal water supply". The fish and wildlife storage volume was determined by the Virginia Commission of Game and Inland Fisheries. Each of the structures is designed to pass the 100-year frequency runoff through the principal spillway without emergency spillway flow. The emergency spillways are designed to safely pass flows from storm events greater than the 100-year frequency and up to the probable maximum storm. Storage capacity is provided for the expected sediment accumulations at each site over a 100-year period. Appurtenant features for the structure with water supply storage include a concrete box intake structure with three slide gates, and a pipe through the dam.

The earthquake hazard was considered in designing the structures. No known archeologic, historic, or scenic value will be disturbed by installation of the project. In the event any such values are identified before or during construction, the project will not proceed until the proper authorities have been notified and the appropriate actions have been taken. Provisions of the Reservoir Salvage Act will also be followed.

Landrights will be acquired on 3,076 acres of land, including 1,786 acres in the pool and construction areas which will be cleared of cutover hardwood and brush. The sediment, water supply, and fish and wildlife pools will occupy 1,841 acres, the detention

pools 987 acres, emergency spillway storage 130 acres, and construction areas 118 acres. Pollution will be minimized during construction through use of approved control measures and by scheduling of operations. All disturbed area outside the permanent pools will be seeded with appropriate vegetation upon completion of construction activities.

Openings will be provided in the risers of all structures for release of required downstream flows.

Structure 1E will be developed for fish and wildlife by the Virginia Commission of Game and Inland Fisheries. Structure 12 will be stocked with fish by the Commission, and Prince Edward County will provide public access and install recreation and sanitary facilities for incidental recreation and fishing use by the public.

All works of improvement installed will comply with applicable federal, state, and local laws and regulations.



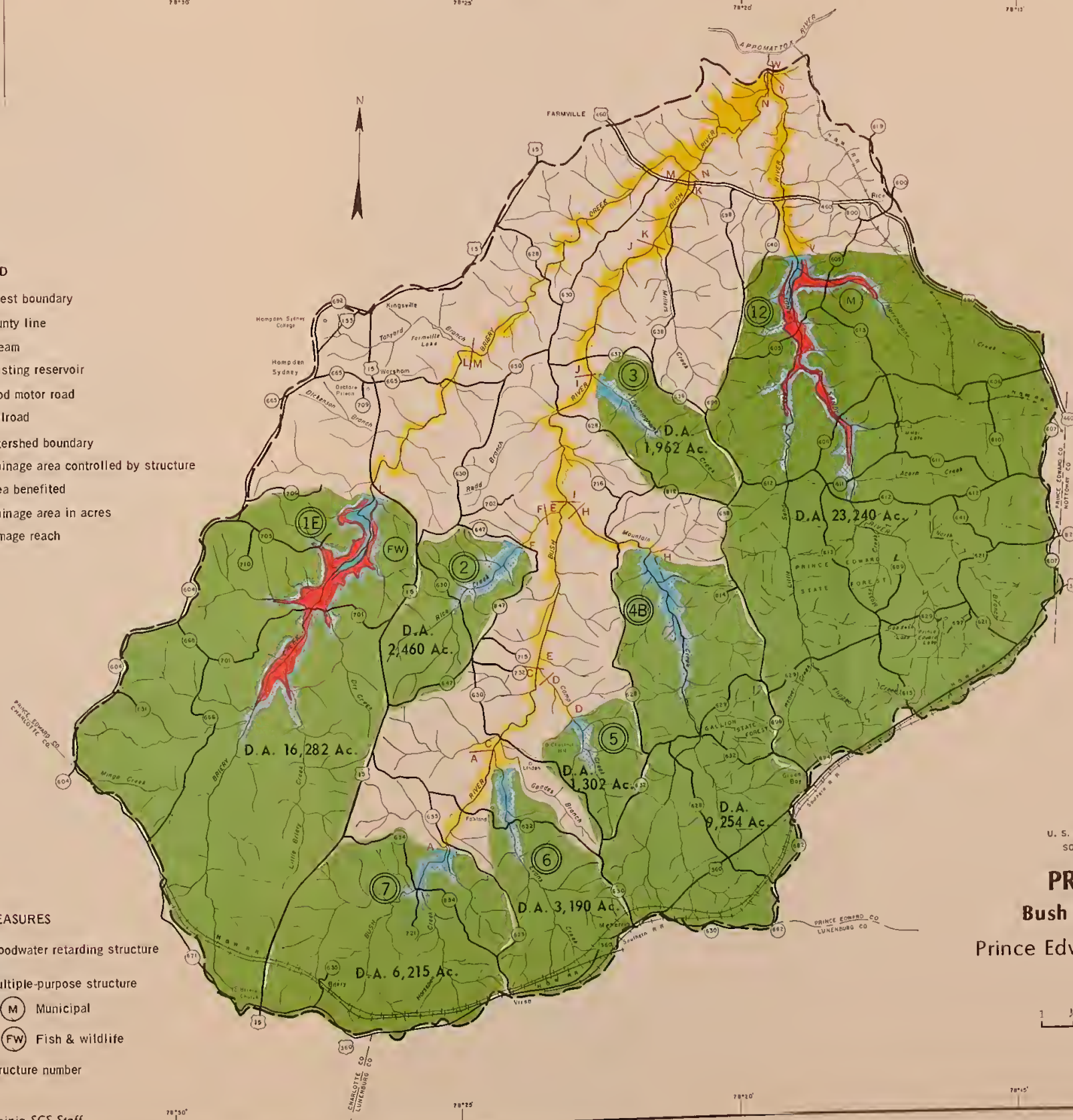


LEGEND

- Forest boundary
- - - County line
- ~ Stream
- ▬ Existing reservoir
- ▬ Good motor road
- ▬ Railroad
- ▬ Watershed boundary
- ▬ Drainage area controlled by structure
- ▬ Area benefited
- D.A. 9,254 Ac. Drainage area in acres
- L M Damage reach

PROJECT MEASURES

- ▬ Floodwater retarding structure
- ▬ Multiple-purpose structure
- (M) Municipal
- (FW) Fish & wildlife
- (2) Structure number



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP

Bush River Watershed

Prince Edward County, Virginia

SEPTEMBER 1975

1 1/2 0 1 2 Miles



INSTALLATION COSTS – MONETARY

Estimated project costs for both land treatment and structural measures are shown in Table 1. Structural measure cost estimates are shown in greater detail in Table 2. Allocation between purposes and sharing of estimated costs between P. L. 566 and other than P. L. 566 funds are shown in Tables 2A and 2B. Cost-sharing percentages shown in the Watershed Plan Agreement will be the basis for sharing actual costs incurred at the time of installation. These percentages are based upon the purposes involved, law and current policy.

LAND TREATMENT MEASURES

Estimated costs for land treatment measures, including technical assistance and installation costs shown in Table 1, are based on recent experiences in installation of similar measures. A comprehensive soil survey has been completed for the county. Technical assistance is required for Inventories and Evaluations and planning for installation of the needed conservation practices. Costs of technical assistance for the installation of woodland management practices are based on actual expenditures and accomplishments of the Virginia Division of Forestry. An analysis of costs against accomplishments was made for each practice to determine unit cost for technical assistance. Technical assistance, on lands undergoing development for other than agricultural uses, is designed to provide guidance to planning boards and individuals to minimize erosion, storm water runoff, and other problems.

The total estimated cost is \$973,900. Included are \$702,700 for installation of the conservation practices, \$258,500 for technical assistance, and \$12,700 for forest fire control. The Virginia Division of Forestry in cooperation with the U.S. Forest Service will use \$15,700 of regular funds and services valued at \$21,000 through the Cooperative Forest Management Program and \$90,300 in P.L. 566 funds for accelerated technical assistance. The Soil Conservation Service will provide \$84,500 from going program funds, the current level of technical assistance in this watershed. The Soil Conservation Service will also expend P.L. 566 funds in the amount of \$47,000 to accelerate technical assistance in the installation of planned conservation practices.

STRUCTURAL MEASURES

Costs of the structures consist of construction, engineering services and landrights costs. Estimated costs for construction, engineering services, landrights, and project administration are based on recent experiences in the installation of similar measures under similar conditions. Project administration costs are estimated to be \$480,000.

Construction cost items are based on bid item schedules from preliminary designs and applicable unit prices from recent contract unit prices for similar work in Virginia. The construction cost is estimated to be \$3,650,100 which includes a 12 percent contingency allowance to cover unusual items or changed conditions at the time of construction. Public Law 566 construction cost is estimated to be \$2,410,750.

Construction costs for sites 2, 3, 4B, 5, 6, and 7, single-purpose floodwater retarding structures, are estimated to be \$128,300, \$144,600, \$178,300, \$95,100, \$111,900, and \$169,900, respectively. The Soil Conservation Service will pay the construction costs for these structures from P.L. 566 funds.

The construction costs for structure 12, multiple-purpose structure for flood control and water supply storage for Prince Edward County, is estimated to be \$1,509,100. The local construction costs for this structure are estimated to be \$766,850; including \$23,100 for features specifically for water supply, all of which will be paid by Prince Edward County in order to incorporate 10,000 acre-feet of municipal and industrial water supply storage in the structure, and to install a raw-water intake system for the specific purpose of water supply.

Structure 1E is planned as a multiple-purpose structure for flood control and fish and wildlife storage for the Virginia Commission of Game and Inland Fisheries. The construction costs for this structure, including basic facilities for fish and wildlife are estimated to be \$1,312,900; of which \$1,069,400 is for the dam and \$243,500 for basic facilities. The local construction costs for this structure are estimated to be \$472,500. These costs include \$334,900 for 50 percent of the joint construction costs allocated to fish and wildlife in this structure, and \$137,600 for the cost of the fish and wildlife basic facilities. These local costs will be provided by the Virginia Commission of Game and Inland Fisheries, to provide 12,254 acre-feet of storage for fish and wildlife purposes.

Engineering services are estimated to cost \$225,750, which includes the usual costs for surveys, design, preparation of plans and specifications, and geologic investigations. Public Law 566 engineering services costs are estimated at \$173,500. Engineering services costs for Prince Edward County are estimated at \$42,600, of which \$3,800 is for the raw-water intake structure and \$38,800 for participation in the design of multiple-purpose structure 12. Engineering services costs for structure 1E and 50.0 percent of these costs for fish and wildlife basic facilities estimated at \$56,100 will be provided by the Soil Conservation Service; and \$9,650 of the engineering services costs will be borne by the Virginia Commission of Game and Inland Fisheries.

Landrights costs were estimated by the sponsors' landrights committee and include all considerations for fee simple titles and flowage easements necessary for the permanent pools and floodwater areas, emergency spillways, dams (including construction zone), and public access to structures 1E and 12. The Virginia Commission of Game and Inland Fisheries has purchased all lands necessary for the construction of structure 1E and the associated fish and wildlife development valued at \$255,800. Prince Edward County has secured approximately 70 percent of the land necessary for the construction of structure 12, and is in the process of securing the remaining areas that will be needed; estimated total cost \$872,400. All landrights necessary for the construction of structures 2, 3, 5, and 7 have been secured by the Piedmont Soil and Water Conservation District; valued at \$97,500. The total value of the landrights necessary for the construction of structures 4B and 6 has been estimated by the sponsors landrights committee at \$107,800. A major portion of these landrights have been secured by the Piedmont Soil and Water Conservation District and negotiations are continuing to secure the remaining necessary tracts. The area required for dams, sediment pools, recreation, fish and wildlife storage, emergency spillways, and water supply pool totals approximately 1,959 acres for the 8 dams. Flowage easements will be obtained on a total of 1,117 acres located between the sediment or beneficial storage pools and the design high water elevations. The total cost of landrights was estimated by the sponsors' landrights committee at \$1,333,500.

Investigation has disclosed that, under present conditions, the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation assistance advisory services and relocation assistance will be provided by the sponsor responsible for the landrights without P.L. 566 cost sharing. Relocation payments will be cost-shared between the responsible sponsor and the Service in accordance with the percentages shown in the Watershed Plan Agreement. Sponsors funds, if needed, will come from local appropriations.

Project administration costs include the cost of contract administration, review of engineering plans prepared by others, government representatives, inspection service during construction, relocation assistance advisory services if needed, clerical and other miscellaneous expenses. These costs to the sponsors and the Soil Conservation Service are estimated to be \$178,000, and \$302,000, respectively. The sponsors' estimated project administration costs include contract administration, inspection services, relocation assistance advisory services if needed, and clerical and other administrative services they provide.

The joint construction, engineering, and landrights costs for multiple-purpose structure 12 were allocated between flood prevention and municipal water supply on the basis of storage provided for each purpose. On this basis, 49.9 percent of the joint costs of structure 12 were allocated to flood prevention and 50.1 percent to municipal water supply. Construction and engineering costs for water supply features in site 12 are for the specific purpose of water supply. The Soil Conservation Service will bear 49.9 percent of the joint construction costs of structure 12 and Prince Edward County will pay 50.1 percent of these costs. Prince Edward County will pay 100 percent of the construction costs associated with the specific features for water supply in this structure.

Engineering services for structure 12, covering both joint and specific cost items, will be provided through an architects and engineers contract secured by the Soil Conservation Service. Prince Edward County will pay 100 percent of the engineering services costs associated with the municipal raw-water intake features and 50.1 percent of the engineering services costs associated with the joint construction items. The Soil Conservation Service will pay 49.9 percent of the engineering services costs associated with the joint construction items for structure 12.

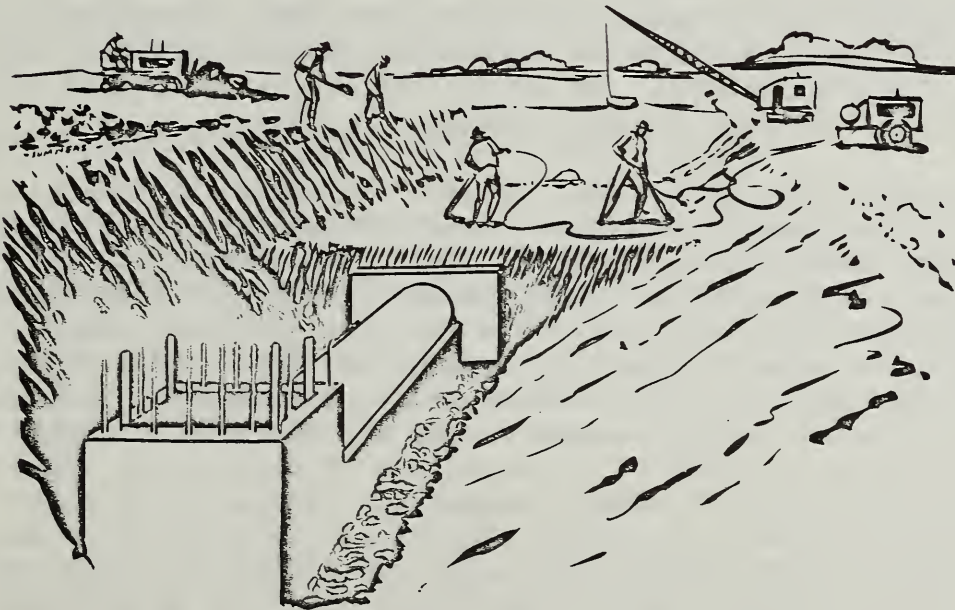
On the basis of storage, 37.4 percent of the joint costs for structure 1E were allocated to flood prevention and 62.6 percent to fish and wildlife development. The Soil Conservation Service will bear 68.7 percent of the joint construction costs of structure 1E, which includes the joint costs allocated to flood prevention and 50 percent of the joint costs allocated to fish and wildlife development storage. The Virginia Commission of Game and Inland Fisheries will bear 31.3 percent of the joint costs for structure 1E, which represents 50 percent of these costs allocated to fish and wildlife storage. As provided for in law and Soil Conservation Service policy, eligible basic fish and wildlife facilities associated with structure 1E will be cost-shared 50.0 percent by the Soil Conservation Service and 50.0 percent by the Virginia Commission of Game and Inland Fisheries. Through agreement with the Commission of Game and Inland Fisheries, the Virginia Department of Highways and Transportation will construct an estimated 3,180 feet of additional access road to the area without P.L. 566 cost-sharing.

The Virginia Commission of Game and Inland Fisheries has requested the Soil Conservation Service to prepare the design, layout, and specifications for multiple-purpose structure 1E, and bear the cost of same, as provided for under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566), as amended.

Structures 2, 3, 4B, 5, 6, and 7 are for single-purpose flood prevention. The Soil Conservation Service, from P.L. 566 funds, will provide the necessary engineering services for the installation of these structures.

The sponsors have established a 7-year project installation period for this project. The estimated obligation of funds, including land treatment and structural measures, for each fiscal year during the installation period is as follows:

Year	P.L. 566 Funds		Other Funds		Total
	Structural	Land	Structural	Land	
	Measures	Treatment	Measures	Treatment	
	\$	\$	\$	\$	\$
1	71,200	19,600	274,350	119,500	484,650
2	914,500	19,600	1,414,200	119,500	2,467,800
3	813,200	19,650	840,050	119,600	1,792,500
4	329,050	19,650	92,000	119,500	560,200
5	359,900	19,650	138,000	119,500	637,050
6	368,200	19,650	26,700	119,500	534,050
7	30,200	19,500	17,800	119,500	187,000
Total	2,886,250	137,300	2,803,100	836,600	6,663,250



BENEFITS – MONETARY

The average annual benefits from structural measures is estimated to be \$749,550. The average annual floodwater damage reduction benefits will be \$155,500. Tables 5 and 6 give details of project benefits.

Floodwater damage to crops and pasture will be reduced \$2,110 annually. Other agricultural benefits will amount to \$41,010 from reduction of damages to farm roads, fences, ponds, and other similar improvements. Reduction of damages to highways and bridges will amount to \$8,270 annually. Damage reduction benefits to commercial properties, utilities, and rural buildings are estimated to be \$3,260 annually.

Benefits to municipal and industrial water storage amount to \$138,970 annually, based on alternative developments costs provided by the consultants for the county.

Sediment and erosion damage reduction benefits have been estimated to average \$114,580 annually, of which \$1,540 will be from reduced overbank deposition, \$40 from reduced flood plain scour and \$113,000 from reduced sediment damages to Lake Chesdin, a municipal water supply reservoir operated by the Appomattox River Water Authority. Basic cost data for sediment removal and disposal were supplied by the Appomattox River Water Authority.

Indirect benefits will amount to \$33,480 annually. These will result from reduction of power failures, late feed deliveries, delayed marketing, loss of work, interrupted public services, expenses of detouring traffic, and other such losses associated with floodwater, sediment and erosion damages.

Flood protection provided by this project including the reduction of depth of flooding by the various storm frequencies will make it possible for landowners to use their lands more effectively and efficiently. Farm operators will have more freedom in selecting proper soil type and slope conditions for their various crops. Benefits from changes in cropping patterns on agricultural flood plain will amount to \$52,250 annually, after allowing for associated costs and increased damage potential, and are listed as changed land use benefits in table 6. Improved use of fertilizer, improved seed varieties, and other modern management practices will allow more efficient and more economical operations. Benefits from more intensive use of agricultural land have been estimated at \$58,380 annually, after allowing for the associated costs for development and production, the potential for increased damages, and a 10-year lag in accrual to provide time for the land use and management changes.

The fish and wildlife development at structure 1E is planned to complement the nearby Prince Edward and Goodwin Lakes, in Prince Edward State Forest, as well as other existing recreational attractions. The major activities which have been planned for fishing,

boating, and nature trails, with possible future development of picnicking and camping facilities. At least 122,000 visits are expected annually. At a value of \$2.00 per visit, the benefits will amount to \$244,000 annually. Structure 12 is expected to provide the opportunity for 37,100 incidental recreation visits annually, with an average annual value of \$2.00 per visit. After providing an average operation and maintenance and replacement cost of \$1.00 per user day, net incidental benefits to this structure amount to \$37,100 annually. Other opportunities for incidental fisheries will be created at the single-purpose flood prevention sites. Public access, safety, and sanitary facilities are essential prior to public use. Public use will be prohibited if any of the necessary services are not provided.

Local secondary benefits resulting from the project are estimated to total \$63,350 annually. Of these benefits, \$11,850 annually are considered induced by the project and will result from increased local income and other returns to local suppliers from expenditures directly associated with the production and marketing of agricultural products. Other local secondary benefits stemming from the project will result from greater use of transportation, processing, and marketing facilities. Local economic development due to the expansion of the municipal water system at Farmville and development of a system for Prince Edward County, along with increased use of the area's utilities and services, will increase both agricultural and general business activities. These benefits amount to \$51,500 annually.

Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation of this project.

COMPARISON OF BENEFITS AND COSTS

Average annual installation cost of structural measures is estimated at \$434,150. Annual primary net benefits from planned structural measures, not including local secondary benefits, are estimated at \$686,200 giving a benefit-cost ratio of 1.6 to 1.0. Inclusion of local secondary benefits increases the average annual benefits to \$749,550, producing a benefit-cost ratio of 1.7 to 1.0. Table 6 summarizes the annual benefits and costs.

INSTALLATION PROVISIONS

The Piedmont Soil and Water Conservation District, the Prince Edward County Board of Supervisors, and the Virginia Commission of Game and Inland Fisheries are the sponsoring local organizations and will be responsible for the successful application of this plan. Responsibilities of other agencies, individuals and organizations will be established by memoranda of understanding and cooperative agreements with the sponsors.

An installation period of 7 years has been established for this project. Conservation practices will be installed more or less uniformly over the entire project installation period. It is anticipated that structure 1E will be installed first, followed by structures 12, 2, 6, 7, 5, 3, and 4B in that order. It is the sponsors' desire to complete all structures by early in the seventh year in order to complete all administrative activities by the end of the project installation period.

LAND TREATMENT MEASURES

The Piedmont Soil and Water Conservation District will coordinate the installation of conservation practices for land treatment proposed in this watershed plan. This responsibility will be defined in memoranda of understanding and cooperative agreements with other agencies, organizations, and individuals.

Landowners and operators will be encouraged to apply and maintain the needed practices and treatment for their lands. The Soil Conservation Service will provide technical assistance to landowners and operators in the planning and application of needed conservation practices.

Woodland management practices will be installed by the landowners with technical assistance from the Virginia Division of Forestry in cooperation with the U.S. Forest Service.

STRUCTURAL MEASURES

Structural measures in this plan consist of six floodwater retarding structures and two multiple-purpose structures. One of the multiple-purpose structures (No. 12) will have municipal and industrial water supply storage, and the other (No. 1E) will have additional storage for fish and wildlife purposes. The Virginia Commission of Game and Inland Fisheries has already obtained all landrights necessary for the installation of structure 1E and the associated fish and wildlife facilities. Prince Edward County has obtained the landrights on 700 acres, and has options on 200 of the remaining 300 acres to be acquired for structure 12. The

Piedmont Soil and Water Conservation District has obtained all landrights necessary for installation on five of the six remaining sites, and acquisition of landrights is in progress on the remaining site. The Prince Edward County Board of Supervisors, one of the three project sponsors, has the right of eminent domain and agrees to use this right if necessary to secure the remaining landrights.

Investigation by the sponsors has revealed that no persons, businesses, or farm operations will be displaced by the installation of this project. However, in securing the landrights, the sponsors will meet the applicable requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. If relocations become necessary, the county will provide relocation assistance advisory services without P.L. 566 financial assistance. Relocation payments will be cost-shared in accordance with percentages shown in the Watershed Plan Agreement. An appraisal of the fair market values of any real property to be acquired will be made by a qualified land appraiser prior to negotiation of a purchase contract. Prince Edward County will be responsible for taking the necessary action to either raise or close roads affected by the permanent pool, and to temporarily close those affected by the flood pool.

The Soil Conservation Service will negotiate, as a part of its project administration services, A&E contracts with consultants for surveys, investigations, design, and preparation of plans and specifications for structure 12. The Prince Edward County Board of Supervisors have requested the Service to let and administer construction contracts for this multiple-purpose structure. The Piedmont Soil and Water Conservation District has requested the Service to provide technical services, and to let and administer contracts on the six floodwater retarding structures.

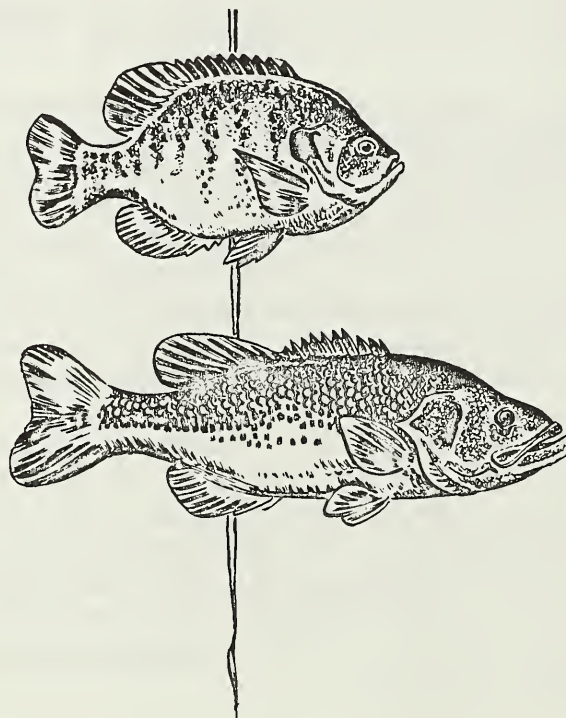
The Virginia Commission of Game and Inland Fisheries will negotiate A&E contracts for surveys, investigations, design, and preparation of plans and specifications for the fish and wildlife features of multiple-purpose structure 1E. The Commission will also let and administer construction contracts for these facilities. The Virginia Commission of Game and Inland Fisheries have requested the Service to provide technical services and to let and administer contracts for this multiple-purpose structure.

The Soil Conservation Service will, at P.L. 566 cost, provide construction inspection for all items on which P.L. 566 funds are spent. The Service will also inspect other items of work where failure to operate as planned could adversely affect the stability or functioning of these cost-shared items of work.

Prince Edward County will provide inspection services deemed necessary to assure that the water supply features for structure 12 will meet contract requirements and function properly. The raw water pumping station, water treatment plant, and water distribution system are nonproject features and will be installed by the county.

The Virginia Commission of Game and Inland Fisheries will install, operate, and maintain the fish and wildlife facilities at structure 1E, and will provide public access to the site. Prince Edward County will provide public access to structure 12, and will install, operate, and maintain facilities for incidental recreation. The recreational, fish and wildlife, and other beneficial use potentials were evaluated for sites 2, 3, 4B, 5, 6, and 7. The results of these studies were reviewed with the sponsors and the appropriate state and federal agencies. Prince Edward County will not allow public access, or permit the use of these sites for incidental recreation, without compliance with state and local health laws and regulations required to protect both the water resource and the user.

The sponsors have presented satisfactory assurances that at least fifty percent of the land above each detention reservoir will be under conservation agreements before construction is initiated.



OPERATION AND MAINTENANCE PROVISIONS

Land treatment measures will be operated and maintained by land-owners and operators through cooperative agreements with the Piedmont Soil and Water Conservation District.

The Virginia Commission of Game and Inland Fisheries will operate and maintain the multiple-purpose structure with planned fish and wildlife development (No. 1E) at an estimated annual cost of \$78,860. Prince Edward County will operate and maintain the multiple-purpose structure with water supply storage (No. 12) at an estimated annual cost of \$2,000. The District will operate and maintain the six floodwater retarding structures (Nos. 2, 3, 4B, 5, 6, and 7) at an estimated annual cost of \$3,900.

Typical operation items will include the operation of water supply gates for structure number 12, and outlet features for downstream releases for all structures. Operation items for all structures will include the removal of trash and debris from the structures, appurtenances, and pool areas after floods. Maintenance items for the structures and appurtenant features may include replacement and revegetation of soil on eroded areas of the vegetated spillways or on the embankments, keeping drainage systems in proper working order, repairs to gates and valves, repainting of exposed metal surfaces, and replacement of rock riprap. Vegetative maintenance includes items such as mowing, fertilizing, reseeding, weed control, and grazing control.

The Virginia Commission of Game and Inland Fisheries will stock the Briery Creek lake with warm-water game fish and will manage the fishery. Planned fish and wildlife facilities, including fishing piers, parking lots, boat ramps, access roads, shelters, and comfort stations will be operated and maintained by the Commission. The Commission will operate and maintain a public water supply system and sanitary facilities as required by state and local health laws and regulations. Sanitary facilities will include septic tanks and drain fields. The capacity will be determined by the consulting engineers using standard guidelines. Solid waste will be collected by the county or their contractor and disposed of at the county land fill. The Commission will also repair and replace equipment and facilities provided for fish and wildlife, develop and enforce needed regulations, prevent pollution of the lake and adjacent areas, dispose of garbage and other refuse, and eliminate safety hazards. The Virginia Commission of Game and Inland Fisheries operational funds will be used for operation and maintenance.

The Virginia Commission of Game and Inland Fisheries will also stock the Sandy River lake (No. 12) with warm-water game fish and manage the fishery. Planned facilities to allow public use at this site to be operated and maintained by the county, are similar

to those at site 1E. Operation and maintenance requirements are the same as for site 1E. Funds for operation and maintenance of the fishery resources and facilities provided for public recreation at this site will be obtained from user fees, not to exceed that amount required to defray these costs and to recover the county's initial investment.

Upon acceptance from the contractor, structural works of improvement will be operated and maintained by the project sponsors. The responsible sponsor will perform the necessary operation and maintenance utilizing his own capabilities or through arrangements with others satisfactory to the Service. However, a time period not to exceed 3 years is allowed for establishment of vegetative cover associated with each structural measure. During this time period, additional work required to obtain satisfactory vegetative cover may be performed with cost sharing at the same rate as for installation of the original works.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structure. These inspections will continue for three years following installation of the dam. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Soil Conservation Service employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Service representative. Any evidence of needed inspections, or improperly performed maintenance, will be reported immediately so that appropriate action can be taken by the responsible sponsor.

Specific operation and maintenance agreements will be executed prior to signing a landrights, relocation, or project agreement. In addition to specific sponsor responsibilities for nonstructural and structural project measures, these agreements will also contain specific provisions for retention and disposal of real and personal property acquired in whole or in part with P.L. 566 funds. The operation and maintenance agreements will contain a reference to the Soil Conservation Service Operation and Maintenance Handbook for Virginia, and an operation and maintenance plan will be prepared for each structure.

FINANCING PROJECT

The estimated \$702,700 cost for application of land treatment will be borne by the landowners and operators with the cost-sharing assistance available under established conservation programs. The total cost of installing forest land treatment measures is estimated to be \$189,800, of which \$26,300 is for state forest land and \$163,500 is for private forest land. Cooperative forest fire protection estimated to cost \$12,700 will continue to be financed through existing conservation programs.

Technical assistance now available through going conservation programs will be continued at about the same rate that existed prior to the development of this plan. The Soil Conservation Service will use \$84,500 from regular program funds, and the Virginia Division of Forestry will use \$15,700 of regular funds and services valued at \$21,000 through the Cooperative Forest Management program. The costs for accelerated technical assistance will be financed from P.L. 566 funds. Of these funds, the U.S. Forest Service will use \$90,300 in cooperation with the Virginia Division of Forestry. The Soil Conservation Service will use \$47,000. Installation costs for forest land treatment measures provided by the landowners are \$26,300 for state forests and \$163,500 on private forest land.

The Virginia Commission of Game and Inland Fisheries will provide the nonfederal share of project costs for structure 1E, estimated to be \$737,950. This includes landrights cost of \$255,800 and the costs of storage and facilities allocated to fish and wildlife. The necessary landrights for this structure have been secured subject to approval of this project plan. Prince Edward County will provide the nonfederal share of the project costs for structure 12, estimated to be \$1,681,850. This includes landrights valued at \$872,400, plus the costs for municipal water supply storage. The nonfederal costs of all other structural measures will be the responsibility of the Piedmont Soil and Water Conservation District, estimated at \$205,300 for landrights for the six single-purpose flood prevention structures. All nonfederal costs will be provided by the responsible sponsor from available local funds.

This plan does not constitute a financial document to serve as a basis for obligation of federal funds. Financial or other assistance to be furnished by the Soil Conservation Service, Forest Service, or the Virginia Division of Forestry in carrying out this watershed plan is contingent upon appropriation of funds for this purpose.



TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Bush River Watershed, Virginia

Installation Cost Item	:	:	:	Number	:	:	Estimated Cost (Dollars) 1/					:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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1/ Price base 1975.

2/ Includes only areas estimated to be adequately treated or protected during project installation period. Treatment will be accelerated throughout the watershed and dollar amounts apply to total areas, not just to adequately treated areas.

3/ Federal agency responsible for assisting in installation of works of improvement.

4/ Includes \$21,000 through the Cooperative Forest Management Program.

5/ Includes P.L. 566 funds for cost sharing for recreation storage.

Date April 1976

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Bush River Watershed, Virginia

Measures	Unit	Applied to Date	Total Cost (Dollars) <u>1/</u>
Brush Control	acres	680	8,160
Conservation Cropping Systems	acres	2,000	8,000
Contour Farming	acres	850	3,400
Crop Residue Management	acres	2,650	10,600
Drain	feet	3,000	1,350
Drainage-Field Ditch	feet	6,982	2,795
Grassed Waterway	acres	48	12,000
Irrigation Storage Reservoir	number	12	9,600
Pasture and Hayland Management	acres	2,525	75,750
Pasture and Hayland Planting	acres	2,485	173,950
Pond	number	61	30,500
Stripcropping	acres	807	8,070
Critical Area Plantings	acres	43	10,750
Minimum Tillage	acres	856	875
Tree Planting	acres	1,570	31,400
Timber Stand Improvement	acres	3,000	7,000
TOTAL	xxx	xxx	394,200

1/ Price Base 1975.

Date: April 1976

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Bush River Watershed, Virginia

(Dollars) 1/

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds			Total	
	Construc- tion	Engineer- ing	Total P.L. 566	Construc- tion	Engineer- ing	Land Rights	Total Other	Installation Cost
Floodwater Retarding Structures:								
No. 2	128,300	13,700	142,000			18,600	18,600	160,600
No. 3	144,600	15,450	160,050			22,500	22,500	182,550
No. 4B	178,300	19,050	197,350			79,900	79,900	277,250
No. 5	95,100	10,300	105,400			13,100	13,100	118,500
No. 6	111,900	11,950	123,850			27,900	27,900	151,750
No. 7	169,900	18,150	188,050			43,300	43,300	231,350
Subtotal	828,100	88,600	916,700			205,300	205,300	1,122,000
Multiple-Purpose Structure								
No. 1E	734,500	48,700	783,200	334,900		255,800	590,700	1,373,900
Fish & Wildlife Facilities	105,900	7,400	113,300	137,600	9,650		147,250	260,550
Multiple-Purpose Structure								
No. 12	742,250	28,800	771,050	743,750	38,800	872,400	1,654,950	2,426,000
Water Supply Features				23,100	3,800		26,900	26,900
Subtotal	2,410,750	173,500	2,584,250	1,239,350	52,250	1,333,500	2,625,100	5,209,350
Project Administration								
	xxx	xxx	302,000	xxx	xxx	xxx	178,000	480,000
GRAND TOTAL	2,410,750	173,500	2,886,250	1,239,350	52,250	1,333,500	2,803,100	5,689,350

1/ Price base: 1975.

2/ Engineering contract costs to be borne \$44,600 by P. L. 566 funds and \$52,250 by other funds.

3/ Includes \$35,800 for surveys, legal fees, and other costs.

Date April 1976

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Bush River Watershed, Virginia

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING			OTHER		
	PURPOSE			:			:		
	Flood Prevention	Mun. Water Storage	Fish and Wildlife	Total	Flood Prevention	Mun. Water Storage	Fish and Wildlife	Total	Flood Prevention Storage Wildlife Total
Floodwater Retarding Structures 2, 3, 4B, 5, 6, and 7	1,122,000			1,122,000	916,700			916,700	205,300
Multiple-Purpose Structure No. 1E	513,850		860,050	1,373,900	418,150		365,050	783,200	590,700
Fish and Wildlife Facilities			260,550	260,550			113,300	113,300	147,250
Multiple-Purpose Structure No. 12	1,210,550	1,215,450		2,426,000	771,050			771,050	1,654,950
Water Supply Features		26,900		26,900				26,900	26,900
GRAND TOTAL	2,846,400	1,242,350	1,120,600	5,209,350	2,105,900		478,350	2,584,250	2,625,100

1/ Price base: 1975.

Date April 1976

TABLE 2B - FISH AND WILDLIFE FACILITIES

ESTIMATED CONSTRUCTION COSTS

Bush River Watershed, Virginia

(Dollars) 1/

Item	<u>2/</u> Number	Estimated Unit Cost	Total Construction Cost
Directional and Warning Signs (as needed)			500
Comfort station and service building	2	40,000	80,000
Boat Launching Ramps	3	3,430	10,290
Car-trailer parking lots	2	18,885	37,770
60-car parking lots	2	7,800	15,600
40-car parking lots	2	4,800	9,600
Wells (water supply)	2	3,000	6,000
Fishing Piers	2	5,000	10,000
Access across cove	1	19,025	19,025
Access roads	3,300 ft.		31,680
Trash receptacles	12	75	900
Contingencies			22,135
GRAND TOTAL			243,500

1/ Price Base 1975.2/ Estimated quantity, subject to minor variation at time of detailed planning.Date: April 1976

TABLE 3 - STRUCTURAL DATA

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STRUCTURES WITH PLANNED STORAGE CAPACITY

Bush River Watershed, Virginia

ITEM	UNIT	1E	2	3	4B	5	6	7	12	TOTAL
Class of Structure										
Drainage Area (Total)	Sq.Mi.	25.44	3.84	3.07	14.46	2.03	4.98	9.71	36.30	xxx
Curve No. (1-day) (AMC II)		70.0	71.0	71.0	71.0	72.0	67.0	67.0	68.0	xxx
Elevation Top of Dam 1/	Ft.	420.0	395.6	350.8	393.0	410.5	412.4	426.0	361.7	xxx
El. Cr. of Primary (Conc.) Em. Sp.	Ft.	407.2	-	-	-	-	-	-	349.5	xxx
El. Cr. of Secondary (Veg) Em. Sp.	Ft.	414.2	386.5	342.4	383.1	401.2	403.5	417.8	355.5	xxx
Elevation Crest Principal Spillway	Ft.	400.0	370.5	332.8	365.4	388.9	388.0	397.4	339.7	xxx
Maximum Height of Dam	Ft.	68.9	47.6	33.3	48.0	38.7	39.6	44.0	57.7	xxx
Volume of Fill	Cu.Yds.	374,000	53,300	67,500	127,800	59,300	80,800	148,700	624,700	1,536,100
Total Capacity 2/	Ac.Ft.	19,567	959	969	3,913	484	1,246	2,239	19,981	49,358
Sediment Submerged	Ac.Ft.	636	144	288	551	86	206	288	1,286	3,485
Sediment Aerated	Ac.Ft.	42	10	19	37	6	14	19	86	233
Beneficial Use (#1-E,F&W; #12, W.S.)	Ac.Ft.	12,254	-	-	-	-	-	-	10,000	22,254
Retarding	Ac.Ft.	6,635	805	662	3,325	392	1,026	1,932	8,609	23,386
Surface Area										xxx
Sediment pool 3/	Acres	(135)	26	50	100	17	41	53	(220)	642
Beneficial use pool (#1-E, F&W; #12, W.S.)	Acres	814	-	-	-	-	-	-	740	1,554
Retarding pool 2/	Acres	1,048	82	94	285	50	100	139	1,030	2,828
Principal Spillway Design										xxx
Rainfall Volume (areal) (1 day)	In.	7.71	8.0	8.0	7.84	8.0	8.0	8.0	7.65	xxx
Rainfall Volume (areal) (10 day)	In.	13.57	13.8	13.8	13.69	13.8	13.8	13.8	13.5	xxx
Runoff Volume (10 day)	In.	6.55	6.95	6.95	6.86	7.16	6.11	6.11	6.08	xxx
Capacity of Principal Spillway	cfs	684	119	103	322	102	110	249	819	xxx
Frequency operation - Emer. Spillway	% chance	1	1	1	1	1	1	1	1	xxx
Dimensions of Conduit	Ft.	5.1x3.9 (HxW)	2.5	2.5	4.0	2.5	2.5	3.5	5.6x4.3 (HxW)	xxx
Emergency Spillway Design										xxx
Rainfall Volume (ESH) (areal)	In.	11.0	8.9	8.9	8.6	8.9	8.9	8.9	10.5	xxx
Runoff Volume (ESH)	In.	7.10	5.37	5.37	5.13	5.49	4.89	4.89	6.68	xxx
Storm Duration	Hrs.	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	xxx
Bottom width of Conc. Chute	Ft.	105	-	-	-	-	-	-	215	xxx
Bottom Width of Veg. Spillway	Ft.	500	150	150	500	100	200	500	500	xxx
Velocity of flow (V _e) 4/	Ft./Sec.	10.0	5.7	5.2	9.4	6.1	5.1	5.6	10.3	xxx
Slope of exit channel 4/	Ft./Ft.	0.023	0.033	0.0350	0.024	0.032	0.036	0.034	0.0220	xxx
Max. reservoir water surface elevation	Ft.	408.5	388.2	343.8	384.3	403.0	404.9	419.3	350.6	xxx
Freeboard Design										xxx
Rainfall Volume (FH) (Areal)	In.	26.50	14.80	14.80	14.36	14.80	14.80	14.80	25.36	xxx
Runoff Volume (FH)	In.	21.97	10.82	10.82	10.40	10.98	10.19	10.19	20.85	xxx
Storm Duration	Hrs.	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	xxx
Max. reservoir water surface elevation	Ft.	420.0	391.2	346.5	388.3	405.8	408.0	422.1	261.7	xxx
Capacity Equivalents										xxx
Sediment Volume	In.	0.50	0.75	1.88	0.76	0.85	0.83	0.59	0.71	xxx
Retarding Volume	In.	4.89	3.93	4.05	4.31	3.62	3.86	3.73	4.45	xxx
Beneficial Volume	In.	9.03	-	-	-	-	-	-	5.16	xxx

1/ Set by class "c" criteria including single-purpose (class "b") structures.

2/ Crest of Emergency Spillway.

3/ Sediment pool only for structures with beneficial storage.

4/ Based on freeboard design storm for structures 1E, 4B and 12.

Date April 1976

TABLE 4 - ANNUAL COST

Bush River Watershed, Virginia

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
All Structural Measures	319,910	84,760	404,670
Project Administration	29,480	xxx	29,480
GRAND TOTAL	349,390	84,760 <u>3/</u>	434,150

1/ Price Base: 1975 - Installation costs in 1975 prices, O & M current (1975) prices.

2/ 100 years at 6-1/8 percent interest.

3/ Includes \$78,860 for operation, maintenance and replacement of basic facilities for the fish and wildlife development.

Date: April 1976

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Bush River Watershed, Virginia

(Dollars) 1/

Item	Estimated Average Annual Damage: Damage		
	Without Project	With Project	: Reduction : Benefit
Floodwater			
Crops and Pasture	3,700	1,590	2,110
Other Agricultural	54,070	13,060	41,010
Roads and Bridges	10,410	2,140	8,270
Other Improvements	3,265	5	3,260
Subtotal	71,445	16,795	54,650
Sediment			
Overbank deposition	2,700	1,160	1,540
Reservoirs and navigable channels	197,240	84,240	113,000
Subtotal	199,940	85,400	114,540
Erosion			
Flood plain Scour	100	60	40
Indirect	53,650	20,170	33,480
Total	325,135	122,425	202,710

1/ Price Base 1975 - Agricultural values (1974) current normalized prices; all other values current (1975) prices.

Date: April 1976

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bush River Watershed, Virginia

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/										%	
	More		Fish and Wildlife		Municipal		Local		Secondary		Total	
	Damage Reduction 2/	Intensive Land Use (Agr.)	Changed Land Use (Agr.)	Recreation	4/ Water Supply	Water	Supply	Secondary	Secondary	Secondary	Average Annual	Benefit : Cost Ratio
All Structural Measures	155,500	58,380	52,250	281,100	138,970	63,350	749,550	404,670	1.9:1.0			
Project Administration	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	29,480	xxx
GRAND TOTAL	155,500	58,380	52,250	281,100	138,970	63,350	749,550	434,150	1.7:1.0			

- 1/ Price Base 1975 - Agricultural values (1974) Current Normalized Prices; all other values current (1975) prices.
- 2/ In addition, it is estimated that land treatment measures will provide floodwater and sediment damage reduction benefits of \$47,210 annually.
- 3/ From Table 4.
- 4/ Includes \$37,100 incidental recreation benefits to structure number 12.

Date: April 1976



TABLE 7 - CONSTRUCTION UNITS

Bush River Watershed, Virginia

(Dollars) 1/

Measures in Construction Unit	Annual Benefit	Annual Cost
Structure 1E only	313,110	181,280
Dams 5, 6, and 7 only	88,730	35,650

1/ Price base 1975 - Agricultural values (1974) current normalized prices; all other values current (1975) prices.

Date: April 1976



PRINCIPLES AND STANDARDS PHASE-IN ADDENDUM

BUSH RIVER WATERSHED PLAN

PRINCE EDWARD COUNTY, VIRGINIA

INTRODUCTION

This addendum was developed in accordance with phase-in procedures adopted by the Water Resources Council for level C studies for which field studies, analyses, and evaluations were completed as of October 25, 1973, and which were formulated in accordance with Senate Document 97 as supplemented and amended.

DISCOUNT RATE COMPARISON

Using an interest rate of 6-1/8 percent, average annual costs of structural measures are estimated to be \$434,150. Annual primary net benefits from planned structural measures, not including local secondary benefits, are estimated to be \$686,200, giving a benefit-cost ratio of 1.6 to 1.0. Inclusion of local secondary benefits will increase the estimated average annual benefits to \$749,550 and the benefit-cost ratio of 1.7 to 1.0.



ABBREVIATED ENVIRONMENTAL QUALITY PLAN

ENVIRONMENTAL CONCERNS

The major environmental concerns within the watershed are related to floodwater damages, erosion and sediment problems, preserving and enhancing fish and wildlife values, and protection of any geological or archeological finds or places of historic interest.

Bush River watershed contains 98,772 acres. Bush River flows in a northerly direction and drains into the Appomattox River, a tributary of the James River. The topography ranges from gently rolling to hilly and is typical of the lower Piedmont Physiographic province. Elevations run from 714 feet above sea level along the headwater ridges to 290 feet at the confluence with the Appomattox River. Land in the flood plain is quite flat when viewed perpendicular to the stream channel and often rises sharply at the intersection of the flood plain and the toe of the hillsides.

Agriculture is the principal industry in the project area and there are many large farms and estates. The major agricultural enterprises in the Bush River watershed project area are dairy, livestock, and field crops (chiefly tobacco, corn, wheat, and soybeans).

The slope of flood plain cropland averages from 1 to 3 percent. Upland cropping areas range from 6 to 15 percent. Interviews with the local people indicate that the natural productive capacity of one acre of well-managed flood plain cropland is equal to at least two acres of well-managed upland cropland.

At the present time, sediment reduces the stream channel capacity, pollutes the water, and prevents sunlight from reaching aquatic plants growing in the water. This affects the quality of the water for human consumption and prevents development of habitat for aquatic ecosystems.

Bush River provides little recreational fishing. Prince Edward and Goodwin lakes are located within the Prince Edward-Gallion State Forest on the headwaters of Sandy River. Fishing is permitted throughout the year on both lakes, however, the facilities are seasonal. Largemouth bass, bluegill, and crappie are the most commonly caught fish in both impoundments. Briery Creek, one of the major tributaries, is a fair fishing stream.

A review of the National Register of Historic Places indicates that there are two historical places within the watershed. These are Worsham-Debtors Prison and Briery Church. From a map study conducted by the Virginia Historic Landmarks Commission, three more historical places were found within the watershed. These are Chestnut Hill, Falkland, and Linden.

The State Archeologist conducted the field examination which failed to reveal any archeological sites which would preclude construction of the various structures.

OBJECTIVES

The environmental objectives are to maintain and enhance the quality of the project area by: (1) protecting its natural beauty, (2) maintaining the quality and quantity of available water, (3) protecting the land by reducing erosion and sediment losses, (4) enhancing the wildlife habitat, and (5) protecting places of historical value and any archeological finds.

COORDINATION AND FORMULATION

Coordination

Input needed for formulation of this plan was provided through meetings and discussions with the sponsors, concerned agencies and organizations, and other interested individuals.

The Formulation Process

The various alternatives considered in the formulation process were: floodwater retarding structures; multiple-purpose structures; accelerated land treatment measures; flood plain acquisition with less intensive uses; no project; flood plain zoning; and combinations of these alternatives.

Some of the alternatives considered would be beneficial to the environment. An example of this is the alternative of flood plain acquisition with less intensive uses. This alternative was not selected due to lack of public support. Some of the alternatives considered would not benefit the environment. An example of this is the installation of structural measures which will cause undesirable changes in land use.

Both flood plain zoning and accelerated land treatment measures were good alternatives environmentally, therefore a combination using both of these was chosen as the alternative to use for the environmental quality plan.

THE ABBREVIATED ENVIRONMENTAL QUALITY PLAN

This plan includes two phases - accelerated land treatment and flood plain zoning.

The land treatment phase is identical with the land treatment phase of the selected plan. Much of the watershed land, through natural means and applied treatment, is now adequately protected to retard surface runoff and to keep erosion to an acceptable level.

The conservation district directors, community leaders, landowners, and representatives of state and federal agencies, agreed that essential land treatment should be applied to 5,393 acres of cropland, 5,571 acres of pastureland, 47,711 acres of forest land, and 2,272 acres of other land.

Conservation practices to be applied to 3,714 acres of pastureland would require pasture management, pasture planting, brush management, and may need planned grazing systems to keep an adequate vegetative cover on the soil.

Accelerated technical assistance through the Piedmont Soil and Water Conservation District, the Virginia Cooperative Extension Service, and the Virginia Division of Forestry through cooperative programs with the U.S. Forest Service would be needed to complete the plan. Existing conservation and multiple use forest management plans would need to be updated. New plans would need to be prepared for land not presently covered. Assistance would be needed in application of practices and for maintenance of vegetative cover now on the ground. Technical assistance would also be needed to develop and interpret soils and other resource information.

The time required to install the accelerated land treatment measures would be 7 years. Conservation practices to be installed on 2,811 acres of cropland include contour farming, conservation cropping system, diversions, grassed waterways, drainage, cover crops, minimum tillage, and crop residue management.

Woodland treatment, with varying degrees of intensity, is planned on 12,450 acres. Fire prevention and insect and disease control would be continued for the total acreage. Combinations of other practices, aimed at reducing erosion and improving hydrologic cover conditions, will include tree planting, timber stand improvement, grazing control and erosion control.

Other conservation land treatment is planned on 835 acres. Areas undergoing development for urban use will receive special attention

to control erosion. The application of these conservation practices would be made by the individual owners or operators controlling the land where treatment is needed.

The county would zone the flood plain to prevent any further development within the limits of the 100-year flood plain. Land use changes in the area would be minor and the flood plain would remain in agricultural production and forest land.

Implementation

The costs for conservation land treatment would be borne by landowners and operators except for cost-sharing assistance available through existing conservation programs. Technical assistance would be furnished by local, state, and federal agencies through their going program funds, plus P.L. 566 funds for necessary acceleration of technical assistance. Each agency would bear the project administration costs it would incur during project installation.

Costs for implementing the flood plain zoning ordinance would be borne by Prince Edward County. Also, the county would have the responsibility of administering the ordinance.

Cost Distribution

<u>Item</u>	<u>(Dollars)</u>
Conservation land treatment	715,400
Technical assistance	258,500
Total land treatment cost	973,900
Flood plain zoning	42,500 1/
Total cost	1,016,400

1/ Includes \$6,000 for establishing ordinances, and \$36,500 for mapping the 100-year flood plain for implementing and enforcing the ordinance.

Effects and Impacts

Flood plain zoning would preserve natural areas and enhance the quality of water, land, and air resources.

Approximately 19,810 acres of watershed land would be affected by the application of conservation land treatment and woodland management. Both vegetative and structural types of conservation land treatment would reduce runoff, conserve soil moisture, and prevent excessive loss of topsoil on farms. Conservation land treatment would help to restore and maintain soil productivity by adding or holding plant nutrients. It would reduce soil losses on cropland and pastureland to tolerable limits thereby maintaining the soil profile for future use to grow plants. Soil losses on 12,450 acres of forest land would be reduced to less than 1 ton per acre per

year. Conservation land treatment would be installed on an estimated 2,811 acres of cropland, 3,714 acres of pastureland and 835 acres of other open land. Land treatment measures would include 30 acres of recreational area improvement.

Degradation of surface water by agricultural pollutants attached to soil particles would be reduced by reducing erosion and by using proper fertilization methods.

Conservation land treatment would reduce the amount of sediment leaving the watershed by about 13,087 tons annually. The sediment from Bush River contributes to the total load in the Appomattox and James Rivers. Therefore, reducing the production of sediment would lessen downstream damages to municipal and industrial water supplies, fish habitat, recreation, and esthetics. Accelerated soil surveys and other resource inventories would provide basic information needed by landowners in planning resource management systems.

The accelerated land treatment and flood plain zoning would help to protect the area's natural beauty. Although land treatment is done by man, it compensates for other man made alterations to the landscape.

Water quality would be maintained but the quantity available for water supply would not be increased. Growth and economic development of the area could not be accomplished at the rate desired by the sponsors due to the inadequate water supply.

Flood damages would continue to occur to agricultural interests, businesses, roads, bridges, and other flood plain improvements.

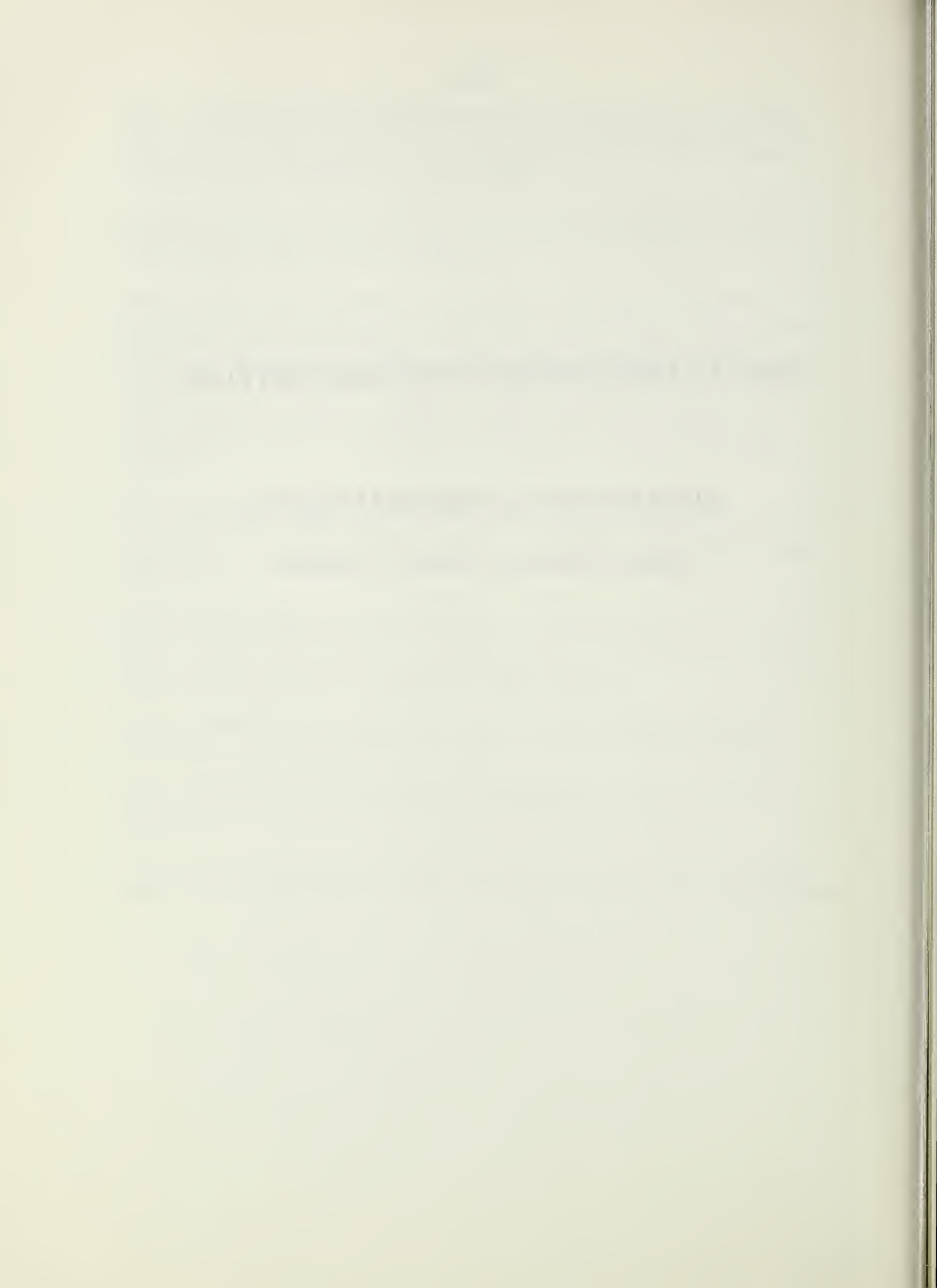
The upland wildlife habitat would be enhanced by the land treatment but the flood plain habitat would not be protected from flooding.

This plan would not protect places of historical or archeological value and the recreation needs of the area would remain unsatisfied.

DISPLAY ACCOUNTS FOR THE SELECTED PLAN

BUSH RIVER WATERSHED PROJECT

PRINCE EDWARD COUNTY, VIRGINIA

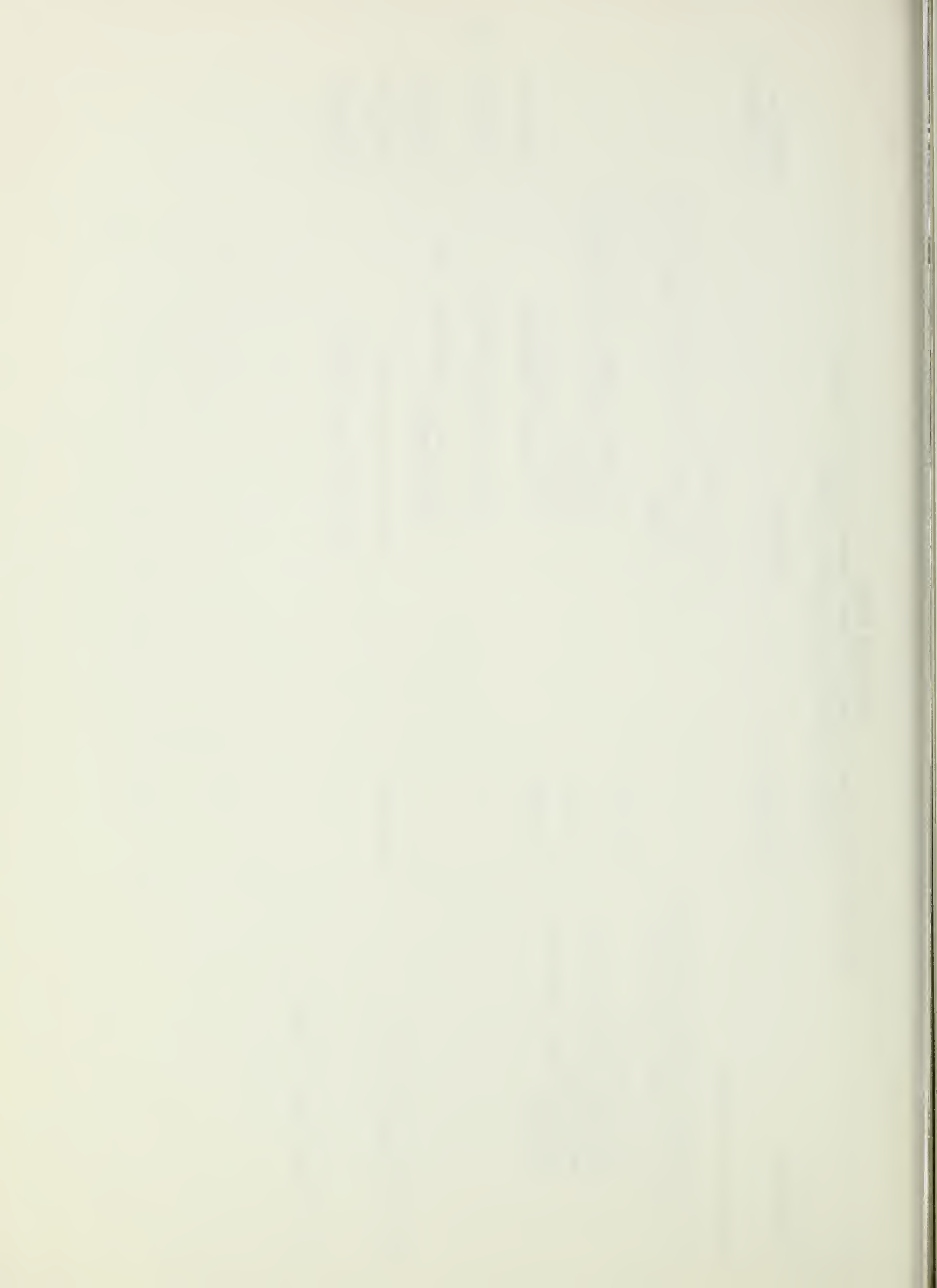


Selected Plan

Bush River Watershed Project, Prince Edward County, Virginia
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measures of Effects</u> <u>1/</u>	<u>Components</u>	<u>Measures of Effects</u> <u>1/</u>
Beneficial effects:		Adverse effects:	
A. The value to users of increased outputs of goods and services		A. The value of resources required for a plan	
1. Flood Prevention	\$266,130	1. Multiple-purpose and flood prevention reservoirs and appurtenances	
2. Municipal and Industrial water supply	138,970	Project Installation (Structural Measures)	\$319,910
3. Recreation and fish and wildlife	281,100	Project Administration	29,480
		Operation, Maintenance and Replacement	84,760
Total beneficial effects	\$686,200	Total adverse effects	\$434,150
		Net beneficial effects	\$252,050

1/ Average annual values.



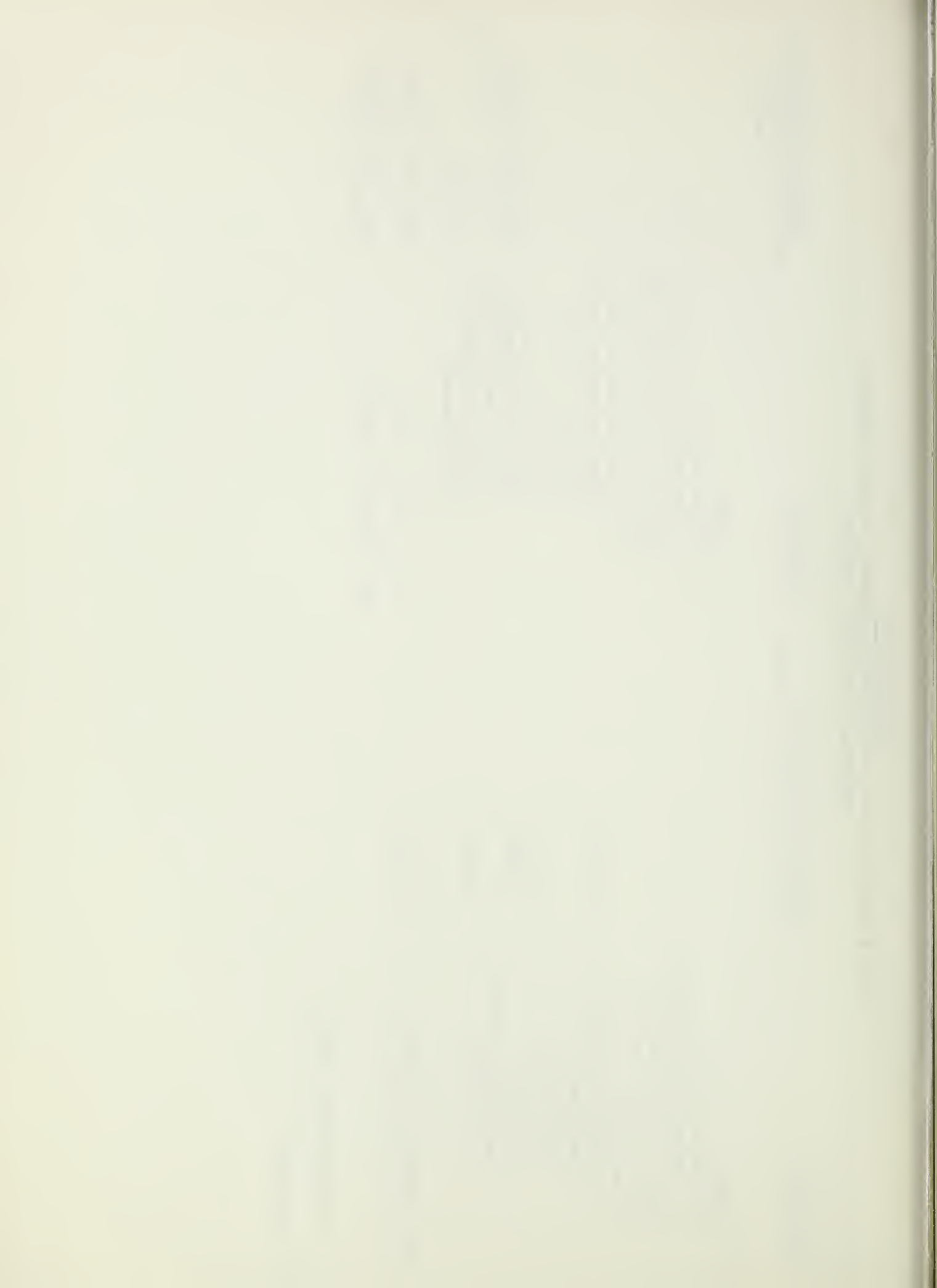
Selected Plan
 Bush River Watershed Project, Prince Edward County, Virginia
 REGIONAL DEVELOPMENT ACCOUNT

Components	Measure of effects 1/ Regional 2/ Rest of Nation		Measure of effects 1/ Regional 2/ Rest of Nation	
	Regional 2/	Rest of Nation	Regional 2/	Rest of Nation
A. Income:				
Beneficial effects:				
1. The value of increased output of goods and services to users residing in the region				
a. Flood Prevention	\$266,130	-		
b. Municipal and Industrial water supply	138,970			
c. Secondary	63,350			
d. Recreation and fish and wildlife	281,100			
Total beneficial effects	\$749,550			
Adverse effects:				
1. The value of resources contributed from within the region to achieve the outputs				
a. Multiple-purpose and flood prevention reservoirs and associated facilities				
Project Installation (Structural Measures)	\$161,210	\$158,700		
Project Administration	10,930	18,550		
Operation, Maintenance and Replacement	84,760			
Total adverse effects	\$256,900	177,250		
Net beneficial effects	\$492,650	-177,250		

I-45

1/ Average annual values.

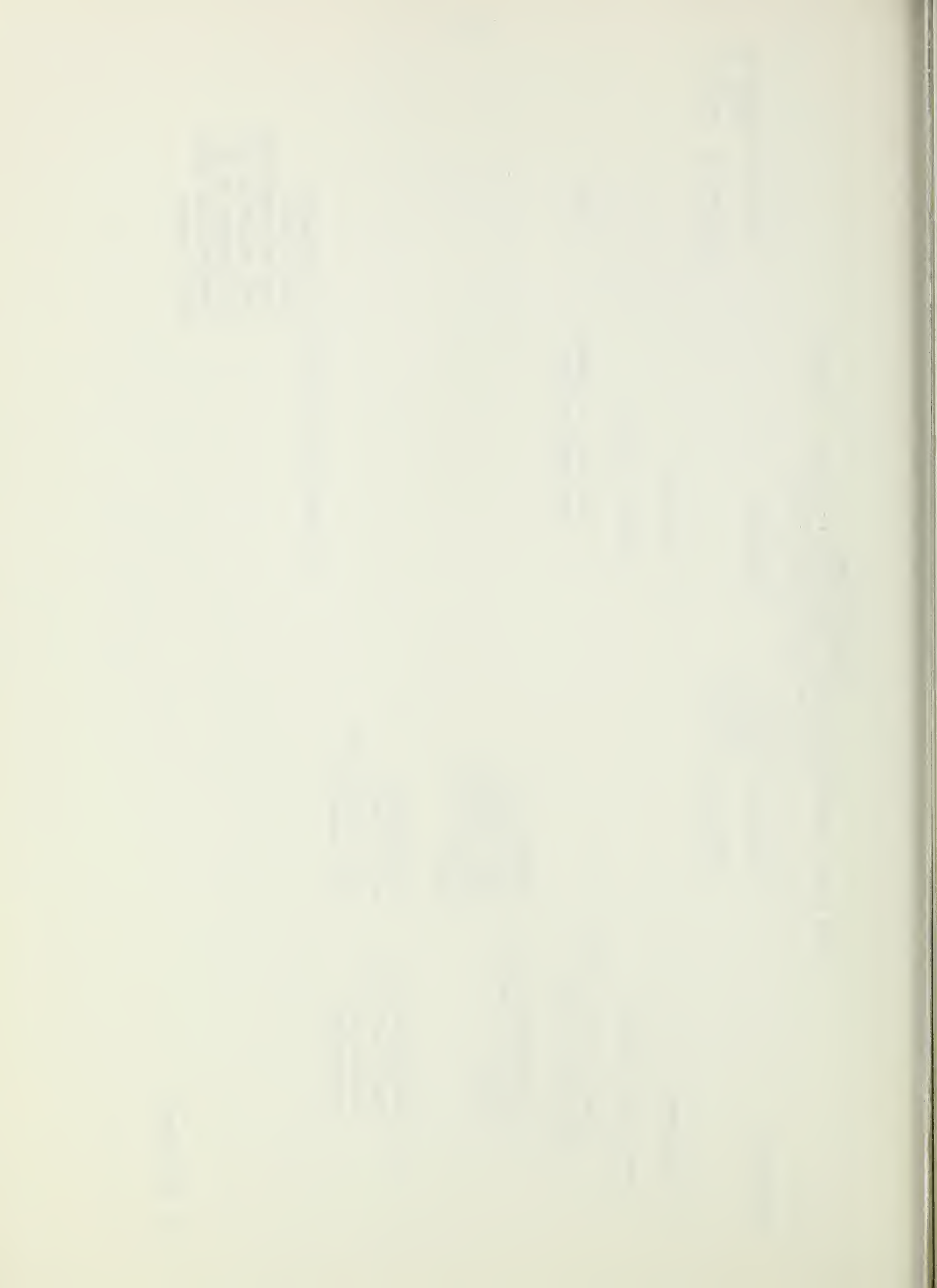
2/ Watershed



Selected Plan
Bush River Watershed Project, Prince Edward County, Virginia
REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measure of effects</u>		<u>Components</u>		<u>Measures of effects</u>	
	<u>Regional</u>	<u>Rest of Nation</u>	<u>Regional</u>	<u>Rest of Nation</u>	<u>Regional</u>	<u>Rest of Nation</u>
B. Employment			B. Employment			
Beneficial effects:			Adverse effects:			
1. Increase in the number and types of jobs			1. Decrease in number and types of jobs		None	-
a. Employment for project construction	Average of 17 semi-skilled jobs annually during installation	-				
b. Employment for operation, maintenance and replacement	30 permanent and 10 part-time semi-skilled jobs annually	-				
			Net beneficial effects:	30 permanent and 10 part-time semi-skilled jobs annually and an average of 17 semi-skilled jobs for 7 years.		-

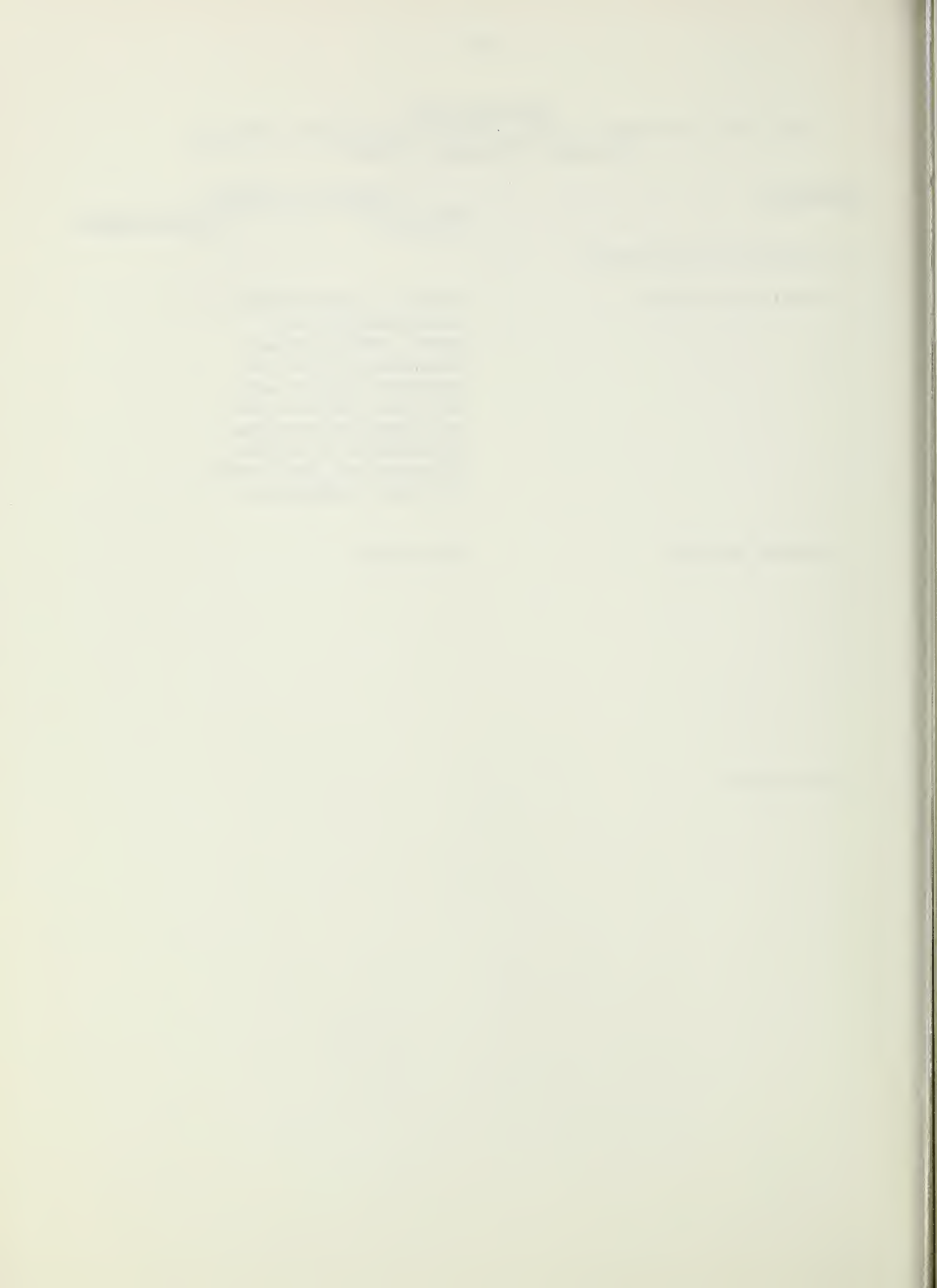
1/ Watershed.



Selected Plan
 Bush River Watershed Project, Prince Edward County, Virginia
 REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measure of effects</u>	
	<u>Regional 1/</u>	<u>Rest of Nation</u>
C. Population Distribution		
Beneficial effects	Create 17 semi-skilled jobs annually for 7 years, during project installation, and 30 permanent and 10 part-time semi-skilled jobs in connection with the utilization of project features and their operation and maintenance.	-
Adverse effects	None known	

1/ Watershed.



Selected PlanBush River Watershed Project, Prince Edward County, Virginia
SOCIAL WELL-BEING ACCOUNTComponentsMeasures of effects

Beneficial and adverse effects:

- | | |
|-------------------------------|---|
| A. Real income distribution | <ol style="list-style-type: none"> 1. Create 30 full time and 10 part-time low to medium income semi-skilled jobs for local residents. 2. Create regional income benefit distribution of \$794,550. 3. Local costs to be borne by the region total \$256,900. |
| B. Life, health and safety | <ol style="list-style-type: none"> 1. Protect existing road system in project area from major damage by the 100-year frequency flood event. 2. Provide for expansion of public water systems to serve about 40 percent of the population projected for Prince Edward County by 1985. 3. Homes with complete plumbing facilities are expected to increase from 70 percent in 1970 to 85 percent in 1985 and 90 percent in 2000. 4. Sediment accumulation will be reduced in Lake Chesdin and the Appomattox and James River estuaries. |
| C. Recreational opportunities | <ol style="list-style-type: none"> 1. Create opportunities for an estimated 122,000 visits annually at the multiple-purpose structure 1E and 37,100 visits for public fishing in the reservoir at structure 12. |

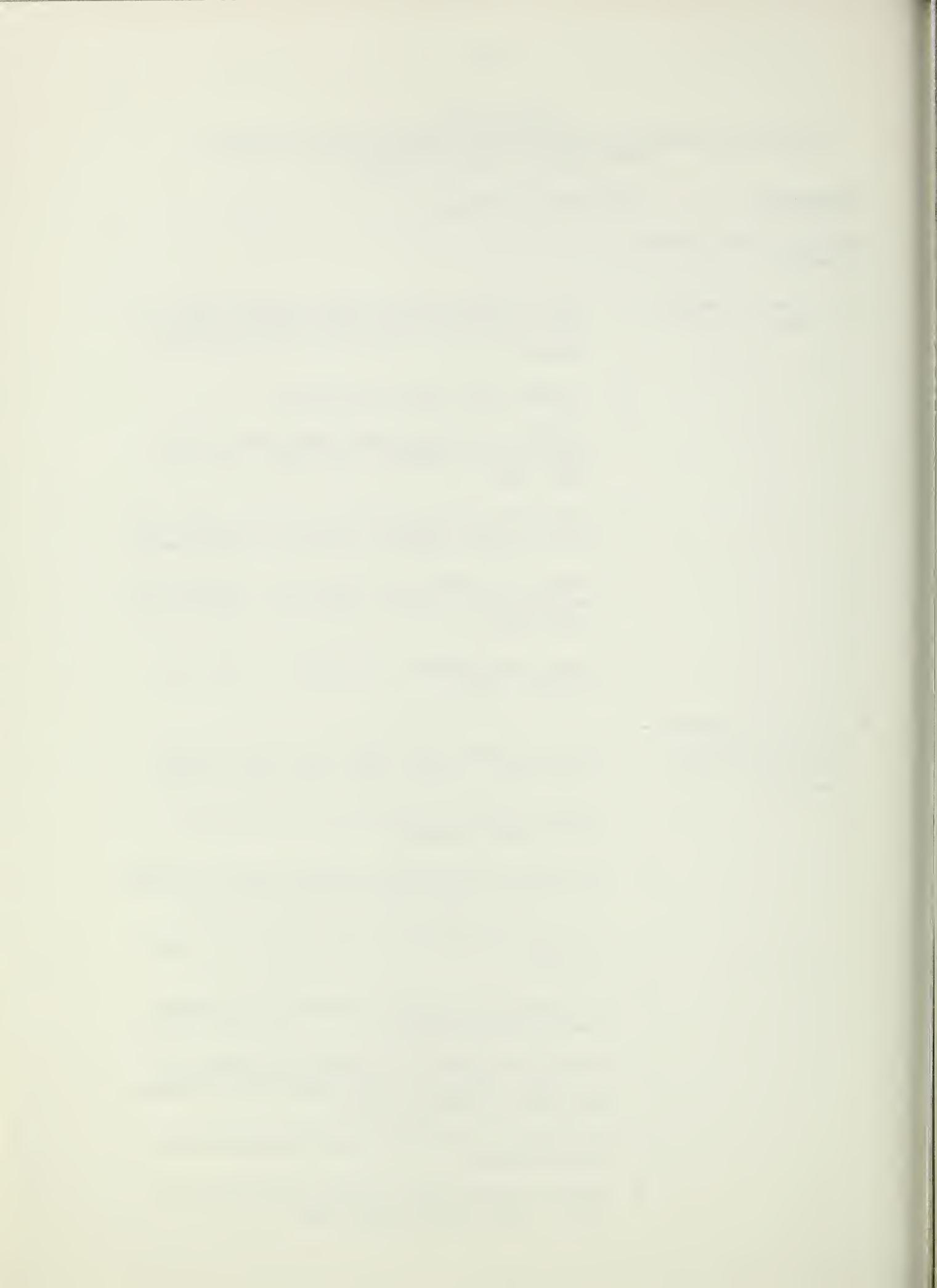


Selected Plan
 Bush River Watershed Project, Prince Edward County, Virginia
 ENVIRONMENTAL QUALITY ACCOUNT

ComponentsMeasures of effects

Beneficial and adverse effects:

- | | |
|--|---|
| A. Areas of natural beauty | <ol style="list-style-type: none"> 1. Create 8 lakes with a total surface area of 1,841 acres in an area with few open water vistas. 2. Inundate 26.7 miles of streams. 3. Inundate or occupy with structures, 1,959 acres now in cropland, pasture, forest and other uses. 4. Intermittent interruption of use of 987 acres now in crops, pasture, forest, or other uses. 5. Change 312 acres now in forest to campgrounds, parking areas, picnic areas, etc. for recreational use. 6. Create approximately 46 miles of shoreline around 8 lakes. |
| B. Quality considerations of water, land and air resources | <ol style="list-style-type: none"> 1. Reduce erosion on 19,810 acres of cropland, pastureland, forest land, and other lands. 2. Reduce sediment leaving the watershed by 39,018 tons annually. 3. Provide a lake of 814 surface acres for public fishing and other water-based activities. 4. Provide high quality source for public water supplies. 5. Provide water storage allowance for minimum downstream releases. 6. Reduce the amount of sediment entering the navigable channels of the James River estuary and port of Hampton Roads. 7. Increase air pollution from increased vehicular traffic. 8. Reduce average gross erosion rates from 5.8 to 4.5 tons per acre per year. |



Selected PlanBush River Watershed Project, Prince Edward County, Virginia
ENVIRONMENTAL QUALITY ACCOUNT

<u>Components</u>	<u>Measures of effects</u>
	9. Provide 312 acres for public recreation activities such as picnicking, nature trails, boating, etc.
C. Biological resources and selected eco-systems	1. Enlarge by 1,554 acres habitat for fish and 1,841 acres for waterfowl. 2. Provide resting areas at 8 lakes for migratory waterfowl. 3. Inundate 20.7 miles of perennial stream having 30 to 40 fish of usable size per mile. 4. Improve upland wildlife habitat by wildlife habitat management practices on 175 acres of land with a conservation plan. 5. Decrease of 1,841 acres of terrestrial wildlife habitat committed to reservoirs (approximately 1.9 percent of the project area.) 6. Convert 1,360 acres of forest and idle land in the protected flood plain to crop and pasture and other uses.
D. Irreversible or irretrievable commitments	1. Commitment to structures, reservoirs, flood pools, open and green spaces of 3,076 acres presently in crops, pasture, forest land, idle and other uses.



PART II

FINAL

ENVIRONMENTAL IMPACT STATEMENT

BUSH RIVER WATERSHED

PRINCE EDWARD COUNTY, VIRGINIA

BUSH RIVER WATERSHED PROJECT

PRINCE EDWARD COUNTY, VIRGINIA

FINAL ENVIRONMENTAL IMPACT STATEMENT

D. N. Grimwood, State Conservationist
Soil Conservation Service

SPONSORING LOCAL ORGANIZATIONS

Piedmont Soil and Water Conservation District
Robert C. Lanier, Chairman
Route 3, Box 344
Amelia, Virginia 23002

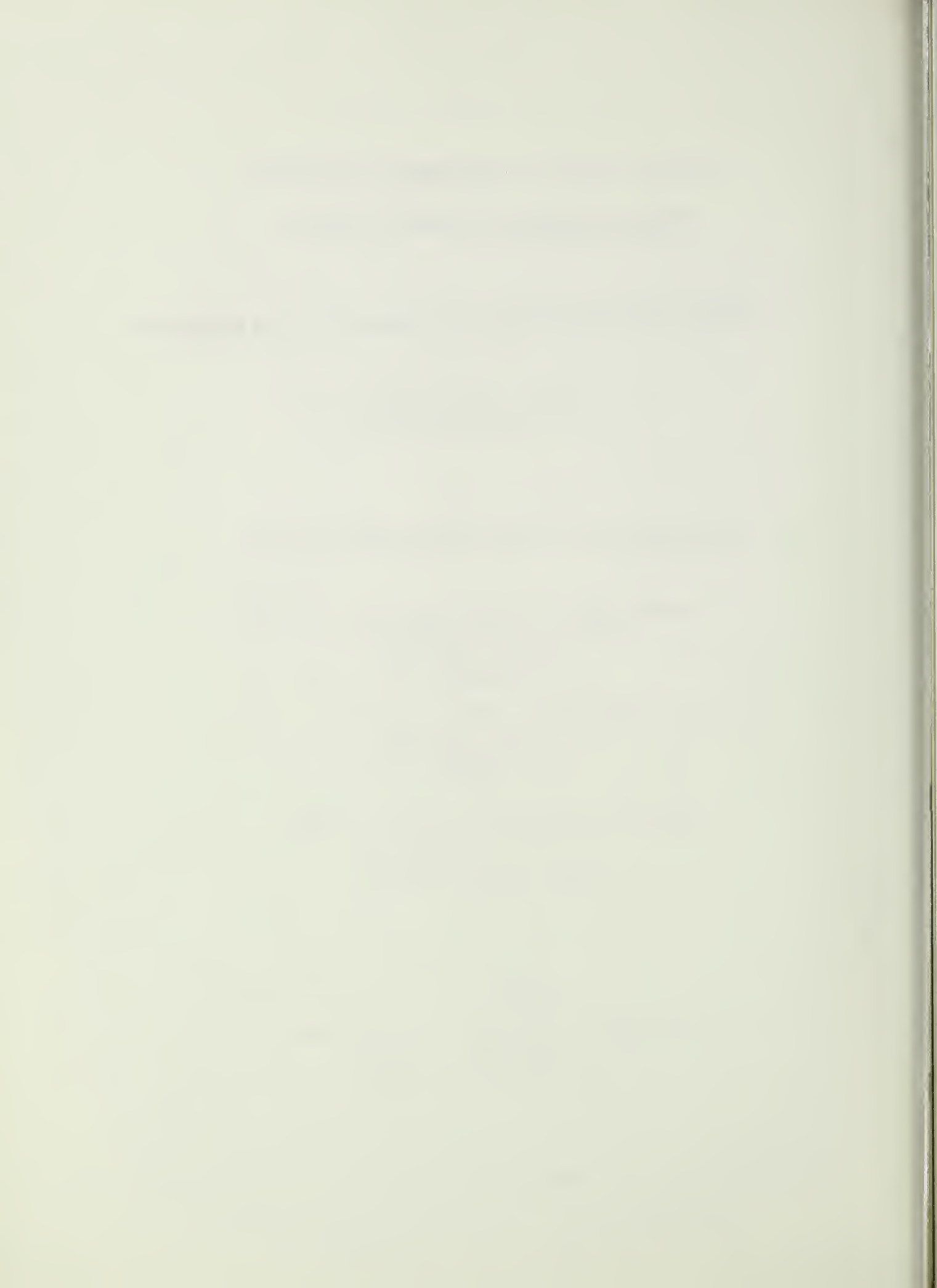
Prince Edward County, Virginia
John C. Steck, Chairman
P. O. Box 382
Farmville, Virginia 23901

Commission of Game and Inland Fisheries
Chester F. Phelps, Director
P. O. Box 11104
Richmond, Virginia 23230

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Richmond, Virginia 23240

April 1976



USDA FINAL ENVIRONMENTAL IMPACT STATEMENT

BUSH RIVER WATERSHED PROJECT

PRINCE EDWARD COUNTY

VIRGINIA

Prepared in Accordance with
Sec. 102(2)(C) of P.L. 91-190

SUMMARY

- I. Final
- II. Soil Conservation Service
- III. Administrative
- IV. Description of Project Purpose and Action:

A project for watershed protection, flood prevention, water supply, and fish and wildlife development in Prince Edward County, Virginia, to be implemented under authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83rd Congress, 68 Stat. 666), as amended.

This project will consist of land treatment on 19,810 acres of the watershed and eight dams. One dam will be built to include municipal and industrial water on Sandy River and one dam will be built to include a fish and wildlife development on Briery Creek. All eight dams to be built will trap sediment, and reduce flooding downstream. Application of conservation land treatment measures will be accomplished under an accelerated program and the going program. Both vegetative and structural types of land treatment measures will be used to reduce runoff, conserve soil moisture, and prevent excessive loss of topsoil on a minimum of 75 percent of the farmland by the end of the project installation period.

- V. Summary of Environmental Impacts Including Favorable and Adverse Environmental Effects:

Floodwater and sediment damages will be reduced by approximately 62 percent. The amount of sediment leaving the watershed will be reduced by approximately 39,018 tons annually. Accelerating installation of land treatment measures on 19,810 acres will reduce erosion, retard runoff, improve wildlife habitat, and enhance the esthetic values of the watershed. The project will provide 814 acres of warm water fish habitat for a planned fish and wildlife development with 14.5 miles of shoreline, 179 acres for facilities to provide 122,000 visits annually at site 1E. It will also provide a maximum of 740 acres of warm water fish habitat, with 17.7 miles of shore line and 47 acres of incidental recreation facilities to provide for 37,100 recreation visits annually at site 12.

The project will create approximately 120 man-years of employment during construction, 30 permanent full time jobs, and 10 permanent part time jobs after project installation is complete. There will be increased stream turbidity at times during construction period.

The project will provide 10,000 acre-feet of high quality water storage which is equal to approximately 3.3 billion gallons which will supply the local needs until the year 2020. Farm income will be increased by allowing more efficient and effective use of about 1,200 of the 3,812 acres of protected flood plain. Downstream sediment damages to the Appomattox River, Lake Chesdin, and the James River will be reduced. The economic, safety, and health conditions in the watershed will be improved by controlling floodwaters.

Additional storage will be provided in the two multiple-purpose structures, to provide a minimum downstream release equal to the 10-year, 7-day low flow. The project will aid in maintaining a sound local tax base by protecting flood plain improvements, providing facilities and technical information necessary for the planned developments, land use changes and use of the area's resources. Wildlife habitat in the flood pools will be protected from future development. Also, terrestrial species in the flood plain below the structures will be protected.

A total of 1,554 acres of water and 45.6 miles of shoreline resting areas for local and migrating waterfowl and wildlife will be created. The project will inundate about 20.7 miles (14.7 percent) of the perennial streams and 6.0 miles (2.9 percent) of intermittent streams in the watershed. It will inundate or restrict use of 3,076 acres of land presently in forest land, cropland, and pastureland.

There will be increased vehicular traffic, noise, fire hazard, solid waste and litter in and near the planned recreation areas. Terrestrial wildlife habitat will be reduced by the 1,841 acres (7.7 percent) in the permanent pools. The project will expose up to 520 acres from drawdown for water supply during prolonged drought at site 12. Approximately 60 acres of Type 1 wetland will be inundated 1/.

Four secondary road crossings and two forest trails will be affected by the permanent pools, and four additional secondary road crossings and one additional forest trail will be affected by the flood pools.

VI. Alternatives:

1. Accelerated conservation land treatment only.
2. Accelerated conservation land treatment with acquisition of flood plain land and flood plain properties.
3. Accelerated conservation land treatment and single-purpose water supply structure.
4. Accelerated conservation land treatment and single-purpose fish and wildlife structure.
5. No project.

VII. Agencies from which written comments have been received:

Department of the Army
 Department of the Interior
 Department of Transportation
 Environmental Protection Agency
 Council on the Environment, Commonwealth of Virginia
 Virginia Soil and Water Conservation Commission

VIII. Draft Statement transmitted to Council on Environmental Quality on November 12, 1975.

1/ Shaw, S.P., and Fredine, C.G. 1956. Wetlands of the United States, United States Department of the Interior, Fish and Wildlife Service, Circular 39.

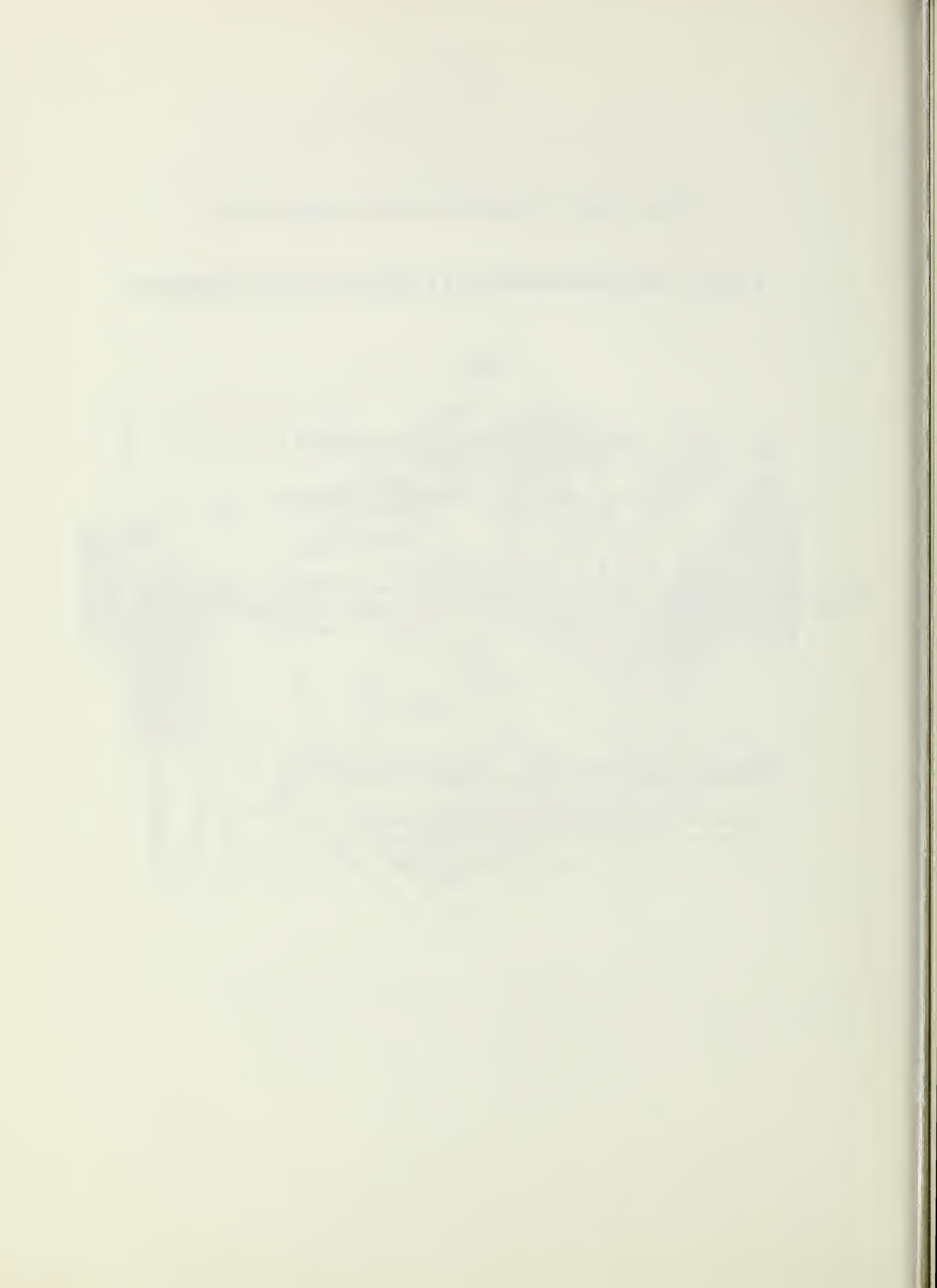


USDA SOIL CONSERVATION SERVICE
FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR
BUSH RIVER WATERSHED
PRINCE EDWARD COUNTY, VIRGINIA

Installation of this project constitutes an administrative action.
Federal assistance will be provided under authority of Public
Law 83-566, 83d Congress, 68 Stat. 666, as amended

SPONSORING LOCAL ORGANIZATIONS

Piedmont Soil and Water Conservation District
Prince Edward County Board of Supervisors
Virginia Commission of Game and Inland Fisheries



PROJECT PURPOSES AND GOALS

The primary purpose of the sponsoring local organizations are watershed protection through conservation land treatment, flood prevention, water supply, fish and wildlife development and preservation of existing fish and wildlife resources.

The watershed application which was submitted by the sponsors on May 17, 1967 indicated the following specific goals and purposes for the Bush River watershed:

1. watershed protection and erosion control through land treatment.
2. flood prevention to agricultural lands and all fixed improvements in the flood plain.
3. water supply for the villages of Green Bay, Meherrin and Rice, and for the town of Farmville.
4. water storage for recreation and fish and wildlife.

Sponsors expect land treatment to reduce the average soil loss per acre on agricultural land to an allowable level. Rates of soil loss on forest land are presently at or below the allowable level, therefore the sponsors are primarily interested in insect and fire control. Other uses requiring treatment include roadways, urban areas and industrial sites.

For the flood prevention goal consideration was asked for a level of protection commensurate with other risks involved in agricultural production. Channel modification was felt to be needed to alleviate flooding and for tile drain outlets. The cost of providing a stable channel and environmental concerns made channel modification infeasible. Subsequently, a two year level of protection to 50 percent of agricultural land below detention structures and protection of all existing highways in the project area from significant damage from the 100-year frequency storm was agreed to.

The application did not specifically include preservation of existing fish and wildlife resources as a goal. However, recognition of the importance of the environment and natural resources led the sponsors to include the preservation goal. This goal is somewhat in conflict with the flood protection goal since to achieve flood protection some land use changes will occur. To partially offset this conflict the sponsors and the Service have emphasized land treatment practices and structural measures that are beneficial to fish and wildlife.

Water supply for Green Bay, Meherrin, Rice and Farmville was a stated goal. Consultations among the governing bodies with the Service and Piedmont Planning District led to the conclusion that a more comprehensive plan for water supply was needed. The goal was then modified to centralize the water supply and include the entire county.

The goal stated in the application was water storage and facilities for wildlife, fisheries and recreation as a part of the flood detention and water supply sites where possible. The practical limit on this goal is the need and the ability of a local sponsor to finance local costs and manage the facility for that purpose. To satisfy this goal as far as practical fish and wildlife enhancement was included in structure 1E and facilities necessary for incidental recreation included in site 12.



PLANNED PROJECT

The Piedmont Soil and Water Conservation District, Prince Edward County Board of Supervisors, and the Virginia Commission of Game and Inland Fisheries, the sponsoring local organizations, will be responsible for the successful application of this project. Their responsibilities will be established by Memorandum of Understanding, and they will be aided through cooperative agreements with other agencies, individuals, and organizations.

An installation period of 7 years has been established for the measures proposed. Land treatment measures will be installed at a reasonably uniform rate during the entire project installation period.

It is anticipated that the structural designs will be initiated during the first year and construction substantially completed by the end of the sixth year, leaving only minor items and final project administration activities to complete the project during the seventh year.

Land Treatment Measures

The Piedmont Soil and Water Conservation District will coordinate the voluntary installation of proposed conservation practices for land treatment. Landowners and operators will be encouraged to apply and maintain the needed conservation practices for land treatment on their lands. The Soil Conservation Service will provide technical assistance to landowners and operators in the planning and application of needed conservation practices. The Virginia Division of Forestry, in cooperation with the U. S. Forest Service, will provide technical assistance with the application of woodland management practices. At least 50 percent of the agricultural land above each structure will be under cooperative agreement with the District before construction is initiated.

The District will make available soils information and other natural resource data. On the basis of this information and the desires of the landowner or operator, conservation treatment alternatives are developed and evaluated. The selected alternatives become the conservation plan to keep soil losses within acceptable limits. Since cropland is most vulnerable to erosion, land with the best productive potential and least erosion hazard is recommended for crops. Land more susceptible to erosion or other hazards is recommended for a use that will allow it to be protected by a vegetative cover such as pasture, trees, or shrubs. Usually these provide food for wildlife and cover as well.

Acreage requiring treatment has been determined and listed based on existing land use acreages. The treatment needs follow for each land use. See the table on page II-33 for present land use.

Cropland

Two thousand three hundred eleven acres of cropland are considered to be adequately treated and cropped under a resource management system. This leaves 5,393 acres that will require varying degrees of conservation treatment. These acres are a major source of sediment. This plan anticipated adequate treatment during project installation on 2,811 of the 5,393 acres needing treatment.

Conservation practices that need to be applied to the cropland include contour farming, conservation cropping system, diversions, grassed waterways, drainage, cover and green manure crops, minimum tillage, and crop residue management. Refer to Appendix D for a more complete explanation of individual land treatment practices. All of these conservation practices help keep protective cover on the soil and reduce soil losses. Many alternative resource management systems which include these measures can be used satisfactorily by the individual landowner. The selection of practices to be installed is based on the needs of specific soils for conservation land treatment as they are used in individual resource management systems.

Pastureland

Three thousand seven hundred fourteen acres of the 9,285 acres in the watershed used for permanent pasture and hay are adequately treated and do not require additional inputs to achieve minimum levels of conservation land treatment. The remaining 5,571 acres require appropriate combinations of planned grazing systems, pasture management, brush management and pasture planting for adequate pastureland resource management systems. Adequate vegetative cover holds the soil in place, reduces soil detachment resulting from raindrop impact, and increases the infiltration of water into the soil. Approximately 1,200 acres of cropland will be converted to pastureland and be planted to provide additional pasture and hay.

A good pastureland resource management system increases the productive capacity of a pasture. In addition, increased forage is available for harvest, wildlife, and production of livestock and related products.

Forest Land

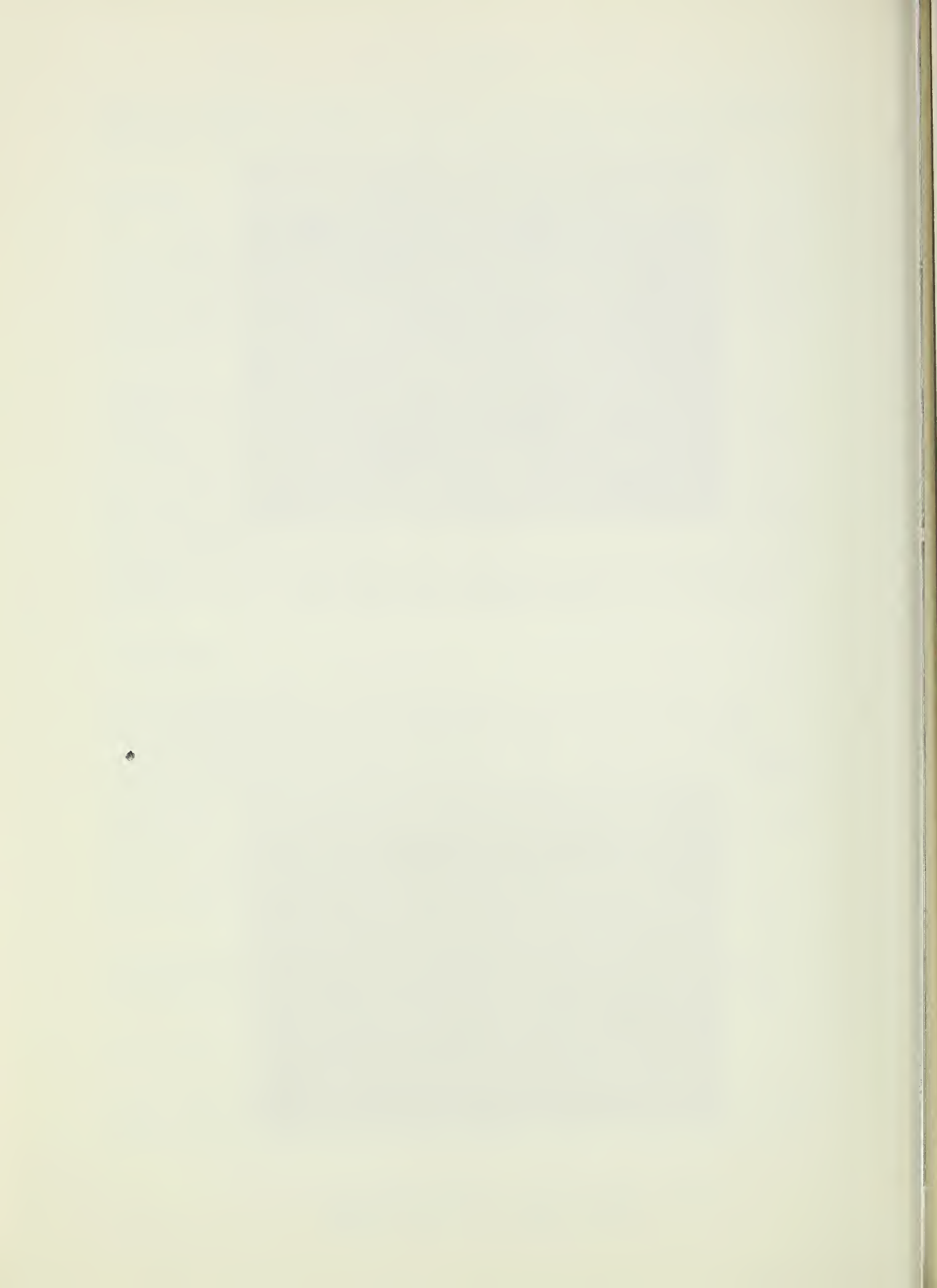
Woodland management practices are planned for 12,450 acres of forest land. Approximately 31,800 acres are now adequately treated. Fire prevention and insect and disease control will be continued on the



Fig. 1 Contented cows on field with proper
land treatment—December 1973



Fig. 2 Field strips of bright tobacco and
KY-31 fescue in 4-year rotation



total acreage. Combinations of other practices, aimed at reducing erosion, improving wildlife habitat and hydrologic cover conditions, will include: tree planting, timber stand improvement, grazing control, erosion control, and seeding grasses, legumes, and wildlife food plantings. The plants used in these practices will be selected with reference to their values to wildlife. The Virginia Division of Forestry will assist individual landowners or operators in selecting woodland management practices needed through development and application of multiple use forest management plans.

Other Land Uses

This category includes 2,272 acres which need land treatment. Areas undergoing development for urban use will receive special attention to control erosion. The actual application of the above practices will be made by the individual owners or operators controlling the land where treatment is needed. Treatment will be designed to meet requirements of the Virginia Erosion and Sediment Control Law. Application of these practices will have secondary benefits such as improving the visual quality of the landscape, general enhancement of the environment, and improved wildlife habitat.

Achieving Needed Land Treatment

Planning and application of conservation practices will be done in cooperation with the Piedmont Soil and Water Conservation District. Technical assistance for planning and application of conservation practices will be provided by the Soil Conservation Service. The Virginia Division of Forestry, in cooperation with the U. S. Forest Service, will provide technical assistance for planning and application of woodland management practices.

The development of a conservation plan is a joint effort between the landowner or operator and the agency representative. A soil survey which gives detailed information about the physical and chemical characteristics of the soils provides much of the basic resource information needed for development of a plan.

The agency representative and landowner or operator inventory and evaluate the soil, water and plant resources. Suitable alternatives for conservation treatment and management are then developed and evaluated.

The landowner or operator selects the combination of conservation practices and management that become the resource management system to meet his objectives for the land. These resource management systems provide the basis for conservation land treatment.

The landowner or operator decisions are recorded in the conservation plan.

Land treatment is achieved as the planned practices are applied by the landowner. Application by the landowner is voluntary.

Structural Measures

Planned structural measures include six floodwater retarding structures and two multiple-purpose structures, as shown on the watershed project map. All structures will have zoned type earth fills. The single-purpose structures will have vegetated emergency spillways, and the multiple-purpose structures will have both structural and vegetated emergency spillways. The principal spillway systems for the single-purpose structures will consist of a reinforced concrete drop inlet riser with a prestressed concrete pipe and an impact basin (see figure 3). The two multiple-purpose structures will have a reinforced concrete drop inlet riser with a reinforced concrete monolithic conduit and a SAF outlet. The plan is based on the principal spillways resting on yielding foundations. The excavated conduit trenches will be backfilled with suitable borrow material.

Each of the structures is designed to pass the 100-year frequency runoff through the principal spillway without emergency spillway flow. The eight structures will provide 23,386 acre-feet of flood storage and will control the runoff from 63,905 acres (99.83 square miles) or 64.7 percent of the total watershed area. The floodwater detention capacity is equivalent to 4.39 inches of runoff from the area above structures, or 2.84 inches from the entire watershed area. These structures have a design life of 100 years and storage is provided for the expected sediment accumulation during this period. The total sediment capacity for all structures will be 3,718 acre-feet, 93.7 percent of which will initially store water.

One of the multiple-purpose structures (No. 1E) will store 12,254 acre-feet for the Virginia Commission of Game and Inland Fisheries for fish and wildlife purposes; the other (No. 12) will store 10,000 acre-feet of municipal and industrial water supply for Prince Edward County.

A search of the literature 1/ discloses that the last recorded earthquake in Prince Edward County was in 1969 with an estimated intensity of III on the Mercalli scale. No major earthquakes have been recorded in Virginia since 1897. A major earthquake is defined as one with an intensity greater than VIII on the Mercalli scale.

This watershed is an Algermissen's Seismic Risk Zone 2 2/ which has earthquake magnitudes (Richter 3/) ranging from 4.5 to 6.0 (magnitude 4.5 = breakage of dishes and disturbances of tail buildings; magnitude 6.0 = walls, monuments, and chimneys fall, and cracks appear in the ground.)

1/ Hopper, M. G., and Bollinger, G. A., The Earthquake History of Virginia, Department of Geological Sciences, Virginia Polytechnic Institute and State University, 1971, 1972.

2/ Algermissen, S. T., Seismic Risk Map of United States, 1969.

3/ Gutenberg, B., and Richter, C. F., Seismicity of The Earth, GSA Spec. Paper 34, 1941; also published by the Princeton University Press.

Soil Conservation Service standards and specifications will be used as a guide in preparing construction contracts for this project. Quality control will be based upon industry standards such as those of the American Society for Testing Materials, American Institute of Steel Construction, American Concrete Institute, American Water Works Association, and Federal Specifications and Standards. Soil Conservation Service structure classifications are determined by the damage that might occur to existing and future developments downstream resulting from a sudden breach of the earth embankment and to the structures themselves. Design criteria for a given structure is then based on the selected classification. The principal spillway is sized to empty the flood storage in ten days or less.

The Soil Conservation Service will insure that appropriate measures will be taken during construction to minimize soil erosion and pollution of the air and water. Specific measures to be included in the plans and specifications will be determined on a site-by-site basis. The plans and specifications will include measures to control erosion and sedimentation such as: temporary vegetation or mulch on exposed areas; reducing the duration of exposure of highly erodible soils to the minimum practical extent; completing and protecting segments of the project as rapidly as construction schedules will permit; the construction of sediment basins and associated diversions to trap sediment at or near its source; additional measures to control erosion should construction be suspended for an appreciable length of time; the installation and maintenance of temporary stream crossings where needed; the use of dust suppressors on access and haul roads to minimize air pollution; specifying the sequence of construction operations to minimize the pollution hazard. It is estimated that a maximum of 26.9 acre-feet of sediment could be produced at the eight sites during construction. The onsite erosion control measures will reduce this amount by about 60 percent to 10.8 acre-feet. The following table shows the estimated sediment concentration for each of the eight sites.

ESTIMATED SEDIMENT CONCENTRATION AT BUSH RIVER SITES 1/

Site Number	Present Conditions	During Construction	Future Conditions
Milligrams Per Liter			
1E	521	591	41
2	740	1030	63
3	1881	2235	154
4B	845	926	62
5	939	1450	68
6	948	1204	67
7	621	758	48
12	852	909	57

1/ These sediment concentrations are based on annual load computations.

Contractors will be required to comply with the provisions of the Construction Safety Act of 1969 (PL-91-54) and applicable state regulations governing open burning and fugitive dust.

Installation of the eight dams will require the purchase of, or flowage easements on 3,076 acres of land; 642 acres in the sediment pools, 1,199 acres in the beneficial use pools, 987 acres in the flood pools, 130 acres above the emergency spillway crest elevations, and 118 acres in the construction areas. Current land use in the areas to be inundated by the sediment and multiple-purpose pools is 158 acres of cropland, 140 acres of pasture, and 1,543 acres of forest and other uses including 60 acres of Type 1 wetland 1/.

Land use in the flood detention pools is 69 acres of cropland, 63 acres of pasture, and 855 acres of forest and other uses. Land use in the construction areas is 7 acres of cropland, 5 acres of pasture, and 106 acres of forest and other uses. Land use in the areas between the emergency spillway crest and design high water elevations is currently 9 acres of cropland, 6 acres of pasture, and 115 acres of forest and other uses.

Construction of the eight dams will require the clearing of approximately 950 acres of forest and other land in the permanent pool areas, and another 43 acres above that level. An additional 200 acres in the construction areas will be cleared and grubbed. This forest land consists of stands of cut-over hardwood and brush.

Investigations by the sponsors have disclosed that, under present conditions, installation of the project will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, Prince Edward County will provide relocation assistance advisory services and relocation assistance. Relocation payments will be cost-shared in accordance with the percentages shown in the Watershed Plan Agreement. Field survey data shows that seven secondary roads and three forest trails, will be affected to some degree by installation of the project. Prince Edward County will take the necessary action to either raise the secondary roads which will be flooded by the permanent pools or close them where this is not economically feasible. Permission will be obtained from the Department of Highways and Transportation to close those roads within the flood pool temporarily during flooding. Section 33.1-223.2 of the Code of Virginia grants authority for temporary closing.

1/ Shaw, S. P., and Fredine, C. G., 1956. Wetlands of the United States, United States Department of the Interior, Fish and Wildlife Service, Circular 39.

The Virginia Commission of Game and Inland Fisheries will have a planned fish and wildlife development at site 1E, which it will own and operate for public use. The Commission has purchased in excess of 2,800 acres of land for this purpose (see Briery Creek Fish and Wildlife Development map, Appendix H-1 and H-2). One area containing 11 acres has been set aside for public access and recreational facilities (see location 1 on map), and an additional 7 acres are available adjacent to this area for future expansion. Public access is already available to this site via State Route 701 from the east bank. A second area containing 13 acres on the west shore has been set aside for the same purpose, with an additional 148 acres available for future expansion (see location 2 on map). Public access to this site will be an extension of State Route 705 across the cove (see location 4 on map). This road will also be extended to site 3 for bank fishing. A fifth area has been designated for construction of a public access road from State Route 701 to an unattended boat launching ramp on the west bank (see location 5 on map).

Prince Edward County will develop site 12 for public recreation separate and apart from this plan. The county has already obtained 700 acres of the approximately 1,000 acres it plans to purchase for municipal and industrial water supply and water treatment facilities. One area containing 35 acres, between State Route 640 and the west bank near the dam, has been set aside for public access and recreational facilities. The construction road extending from State Route 640 to the dam will be used for public access to this area. Another area containing 12 acres, located adjacent to State Route 605 along the east bank has been designated for the same purpose. Since this reservoir will be used for public water supply, activities such as swimming, wading, and water skiing will be prohibited. Boating will also be limited to small craft with electric motors.

The Virginia Commission of Game and Inland Fisheries will stock both of the multiple-purpose reservoirs (1E and 12) with largemouth bass, bluegill sunfish, channel catfish, and possibly other warm-water species. They will also manage the fishery, which will furnish bank and boat fishing on a total of 1,554 acres.

The recreational, fish and wildlife, and other beneficial use potentials were evaluated for sites 2, 3, 4B, 5, 6, and 7. These results were reviewed with the sponsors, and they decided not to develop these sites after careful consideration of the potentials and resources. Prince Edward County will not allow public access to these sites, or issue a permit for use by other interests, unless facilities which meet all health and sanitary requirements by state and local government are provided. The general public will be prohibited from using these sites for recreation through cooperative agreements between the county and the affected landowners.

The National Register of Historic Places lists three historical sites in Prince Edward County, two of which are within the watershed boundary. The Virginia Historic Landmarks Commission made a study of the watershed area in which they listed three additional places of historical interest. None of the above places will be adversely affected by the actual installation of this project.

The State Archeologist's report shows there are no archeological or historical resources that will be adversely affected by the project. The National Park Service and the Virginia State Archeologist will be notified if any previously unidentified evidence of cultural values are discovered during detailed investigations or construction in accordance with the Archeological and Historical Preservation Act (P.L. 93-291). Any planned recovery, protection or preservation operations will also follow procedures in P.L. 93-291. Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

Provisions have been made for the release of flow from near the top of the permanent pools. Openings in the risers will be sized to release amount up to normal flow. Additional storage will be available in the two multiple-purpose sites (1E and 12) for a guaranteed release rate equal to the 10-year, 7-day low flow. The purpose of this downstream release is to mitigate the effects of diverting water for municipal and industrial purpose, and also to compensate for water losses such as evaporation and seepage. No such storage was provided in the other six sites since low-flow augmentation is not a project purpose. However, Virginia state law requires that the flow below an impoundment be at least equal to the flow immediately above the structure when that flow is equal to or less than the average flow. Therefore, these openings will provide the necessary means for releasing water to maintain the required downstream flow.

Design features peculiar to each site were considered and findings, along with recommendations, are included under individual site headings below.

Site 1E (Briery Creek) - This site is located on the Briery Creek tributary approximately 0.2 mile upstream from U. S. Highway 15. It has a drainage area of 25.44 square miles. Storage amounts for this structure are 6,635 acre-feet of floodwater storage, 678 acre-feet of sediment storage, and 12,254 acre-feet of fish and wildlife storage. The structure will have a 105-foot reinforced concrete chute with a straight inlet, and a 500-foot vegetated spillway as the primary and secondary emergency spillways, respectively. The concrete chute will be constructed over the fill, and the vegetated

spillway will be around the left abutment. A Case I layout was used for the vegetated spillway, and the entrance channel will be filled and diked to obtain a minimum bulk length of 600 feet. Two other dikes will extend across saddles on either side of the emergency spillway. The principal spillway system will have a 5.1 feet by 3.9 feet (H X W) reinforced concrete monolith conduit.

The dam will be about 69 feet high and will be constructed of approximately 374,000 cubic yards of compacted fill, including 24,200 cubic yards of backfill for the cutoff and pipe trenches and 28,400 cubic yards for the dikes and emergency spillway entrance channel. The emergency spillway will yield approximately 43,800 cubic yards of sandy silt (ML) and silty sand (SM). The remaining 330,200 cubic yards will be obtained from the flood plain and left abutment areas below the recreation pool level and will be mainly silty sand (SM) with some ML and GM.

A cutoff trench will be excavated to relatively impermeable foundation material consisting of arkosic sandstone, overlying red shale in the left abutment to gneiss and schist in the right abutment. Leakage problems should be minor, but some care must be taken along the contact between sandstone-shale and schist.

Provisions have been made in the design of this structure for releasing the required downstream flows from near the lake surface. Openings will be sized to release amounts up to normal flow, with a minimum value equal to the 10-year, 7-day low flow (0.89 mgd).

Facilities for the planned fish and wildlife development will consist of access roads, three boat launching ramps, six parking lots, two combination comfort station-service buildings with wells for fresh water supplies and modern sanitary facilities, two fishing piers, and trash receptacles. Additional land is available near the two comfort stations for future development as picnic and camping sites. Safety features will include directional and warning signs at appropriate locations around the lake. These signs will include warning of the danger from submerged and emergent timber. These facilities will be adequate for full use of the lake (122,000 visits annually). All facilities will be designed to provide safety for all users, and will include provisions for use by handicapped persons. Suitability of this site for the planned fish and wildlife development is based on a report prepared by the Virginia Commission of Game and Inland Fisheries.

Site 2 (Rice Creek) - This site is located on the Rice Creek tributary approximately 0.3 mile upstream from State Route 647. It has a drainage area of 3.84 square miles. The structure will provide a total storage capacity of 959 acre-feet, including 805 acre-feet of floodwater storage and 154 acre-feet of sediment storage. The structure will have a 150-foot vegetated emergency spillway, and a 30-inch reinforced concrete pipe for the principal spillway.

The dam will be about 48 feet high and will be constructed of approximately 53,300 cubic yards of compacted fill, including 2,100 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway will yield approximately 57,500 cubic yards of silty sand (SM) and gravel (GM), and approximately 7,000 cubic yards of rock; therefore, no additional borrow is needed.

A cutoff trench will be excavated to relatively impermeable foundation material consisting of granite gneiss. Leakage problems should be minor.

Site 3 (Cunninghams Creek) - This site is located on the Cunninghams Creek tributary approximately 0.3 mile upstream from its junction with Bush River. It has a drainage area of 3.07 square miles. The structure will provide a total storage capacity of 969 acre-feet; including 662 acre-feet of floodwater storage and 307 acre-feet of sediment storage. The structure will have a 150-foot vegetated emergency spillway, and a 30-inch reinforced concrete pipe for the principal spillway.

The dam will be about 33 feet high and will be constructed of approximately 67,500 cubic yards of compacted fill, including 2,400 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway will yield approximately 42,800 cubic yards of silty sand (SM) and sandy silt (ML), and approximately 9,800 cubic yards of rock. The remaining 14,900 cubic yards will have to be obtained from the abutment areas above the sediment pool level because the flood plain has been swamped out by beaver dams; borrow from the abutment areas will be mainly silty sand (SM) and sandy silt (ML).

A cutoff trench will be excavated to relatively impermeable foundation material consisting of granite gneiss. Leakage problems should be minor.

Site 4B (Mountain Creek) - This site is located on the Mountain Creek tributary approximately 0.8 mile upstream from State Route 628. It has a drainage area of 14.46 square miles. The structure will provide a total storage capacity of 3,913 acre-feet, including 3,325 acre-feet of floodwater storage and 588 acre-feet of sediment storage. The structure will have a 500-foot vegetated emergency spillway, and a 48-inch reinforced concrete pipe for the principal spillway.

Since the drainage area of the structure exceeds 10 square miles, it was necessary to modify the design from the other class "b" structures in accordance with Soil Conservation Service criteria. A Case I layout was used for the design and the entrance channel will be filled and diked to obtain a minimum bulk length of 600 feet.

The dam will be about 48 feet high, and will be constructed of approximately 127,800 cubic yards of compacted fill, including 6,200 cubic yards of backfill for the cutoff and pipe trenches, and 46,800 cubic yards for the emergency spillway entrance channel and dike. The emergency spillway will yield approximately 120,200 cubic yards of silty sand (SM) and sandy silt (ML); therefore, the emergency spillway can be altered slightly to obtain a balance between cut and fill.

A cutoff trench will be excavated to relatively impermeable foundation material which is mainly schist. Leakage problems should be minor.

Site 5 (Camp Creek) - This site is located on the Camp Creek tributary approximately 1.2 miles upstream from its junction with Bush River. It has a drainage area of 2.03 square miles. The structure will provide a total storage capacity of 484 acre-feet, including 392 acre-feet of floodwater storage and 92 acre-feet of sediment storage. The structure will have a 100-foot vegetated emergency spillway, and a 30-inch reinforced concrete pipe for the principal spillway.

The dam will be about 39 feet high, and will be constructed of approximately 59,300 cubic yards of compacted fill including 9,400 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway will yield approximately 53,500 cubic yards of silty sand (SM), sandy silt (ML), and sandy gravel (GM), and approximately 8,400 cubic yards of rock; therefore no additional borrow is needed.

A cutoff trench will be excavated to relatively impermeable foundation material which is mainly granite gneiss. Leakage problems should be minor.

Site 6 (Evans Creek) - This site is located on the Evans Creek tributary approximately 0.3 mile upstream from its junction with Bush River. It has a drainage area of 4.98 square miles. The structure will provide a total storage capacity of 1,246 acre-feet, including 1,026 acre-feet of floodwater storage and 220 acre-feet of sediment storage. The structure will have a 200-foot vegetated emergency spillway, and a 30-inch reinforced concrete pipe for the principal spillway.

The dam will be about 40 feet high, and will be constructed of approximately 80,800 cubic yards of compacted fill, including 2,000 cubic yards of backfill for the cutoff and pipe trenches. The emergency

spillway will yield approximately 43,100 cubic yards of silty sand (SM) and sandy silt (ML) with quartz fragments. The remaining 37,700 cubic yards of borrow is available from the right abutment above the sediment pool level; borrow from these areas will consist of SM and ML.

A cutoff trench will be excavated to relatively impermeable foundation material consisting mainly of schist and phyllite. Leakage problems should be minor.

Site 7 (Main Stem) - This site is located on the main stem of Bush River approximately 0.2 mile upstream from State Route 633. It has a drainage area of 9.71 square miles. The structure will provide a total storage capacity of 2,239 acre-feet, including 1,932 acre-feet of floodwater storage and 307 acre-feet of sediment storage. The structure will have a 500-foot vegetated emergency spillway, and a 42-inch reinforced concrete pipe for the principal spillway.

The dam will be about 44 feet high, and will be constructed of approximately 148,700 cubic yards of fill, including 7,600 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway will yield approximately 48,500 cubic yards of silty sand (SM), sandy silt (ML), some sandy-silty clay (CL), and silty gravel (GM). The remaining 100,200 cubic yards of borrow material is available from the right abutment above the sediment pool level, and consists of silty sand (SM) and sandy silt (ML).

A cutoff trench will be excavated to relatively impermeable material, consisting mainly of schist and gneiss. Leakage problems should be minor.

Site 12 (Sandy River) - This site is located on the Sandy River tributary approximately 1.2 miles upstream from U. S. Highway 460. It has a drainage area of 36.30 square miles. Storage amounts for this structure are 8,609 acre-feet of floodwater storage, 1,372 acre-feet of sediment storage, and 10,000 acre-feet of water supply storage. The structure will have a 215-foot reinforced concrete chute with a straight inlet and a 500-foot vegetated spillway as the primary and secondary emergency spillways, respectively. The concrete chute will be constructed over the fill, and the vegetated spillway will be around the left abutment. A Case I layout was used for the vegetated spillway, and the entrance channel will be filled and diked to obtain a minimum bulk length of 600 feet. The principal spillway system will have a 5.6 feet by 4.3 feet (H X W) reinforced concrete monolith conduit.

The dam will be about 58 feet high, and will be constructed of approximately 624,700 cubic yards of compacted fill, including 71,100 cubic yards of backfill for the cutoff and pipe trenches and 47,000

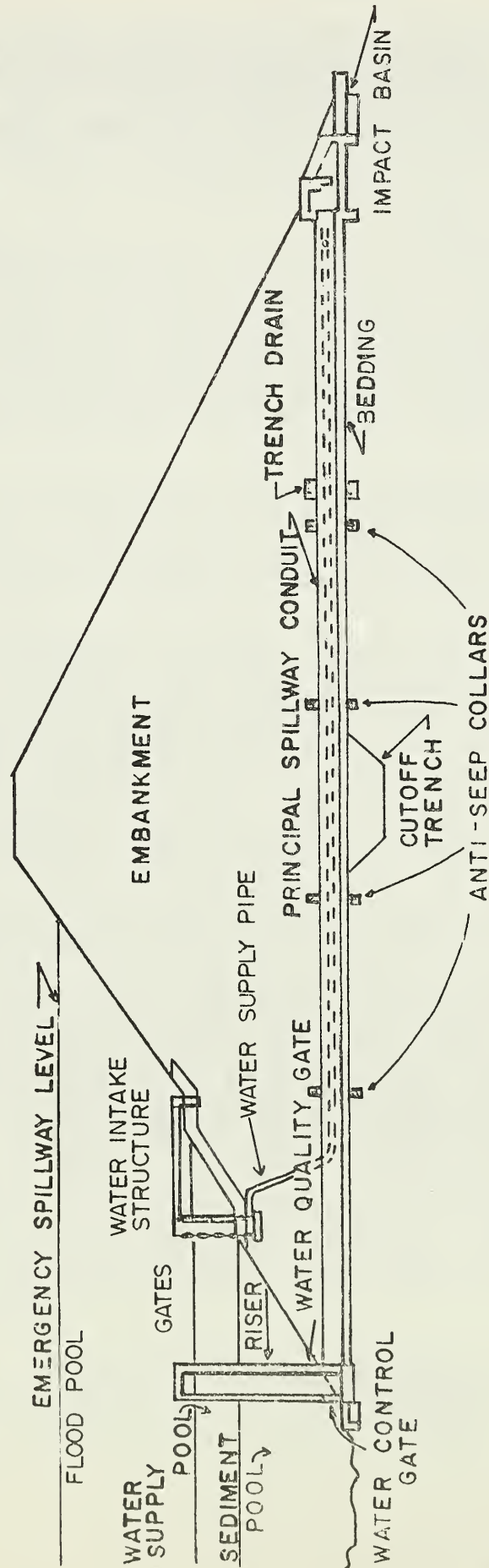
cubic yards for the emergency spillway entrance channel and dike. The emergency spillway will yield approximately 212,200 cubic yards of silty sand (SM), sandy silt (ML), and sandy clay (CL). The remaining 412,500 cubic yards is available below the water supply pool level, from the abutments and lower valley slopes upstream. This borrow will be similar to the spillway material but with a higher percentage of silt and clay.

A cutoff trench will be excavated to relatively impermeable foundation material consisting mainly of granite and hornblende gneiss. Drilling indicated the presence of vertical jointing under the flood plain and horizontal jointing in the abutments. Some artesian pressure was found in the vertical joints under the flood plain. A detailed site investigation will determine what foundation treatment will be necessary.

Provisions have been made in the design of this structure for releasing the required downstream flows from near the lake surface. Openings will be sized to release amounts up to normal flow, with a minimum value equal to the 10-year, 7-day low flow (1.27 mgd).

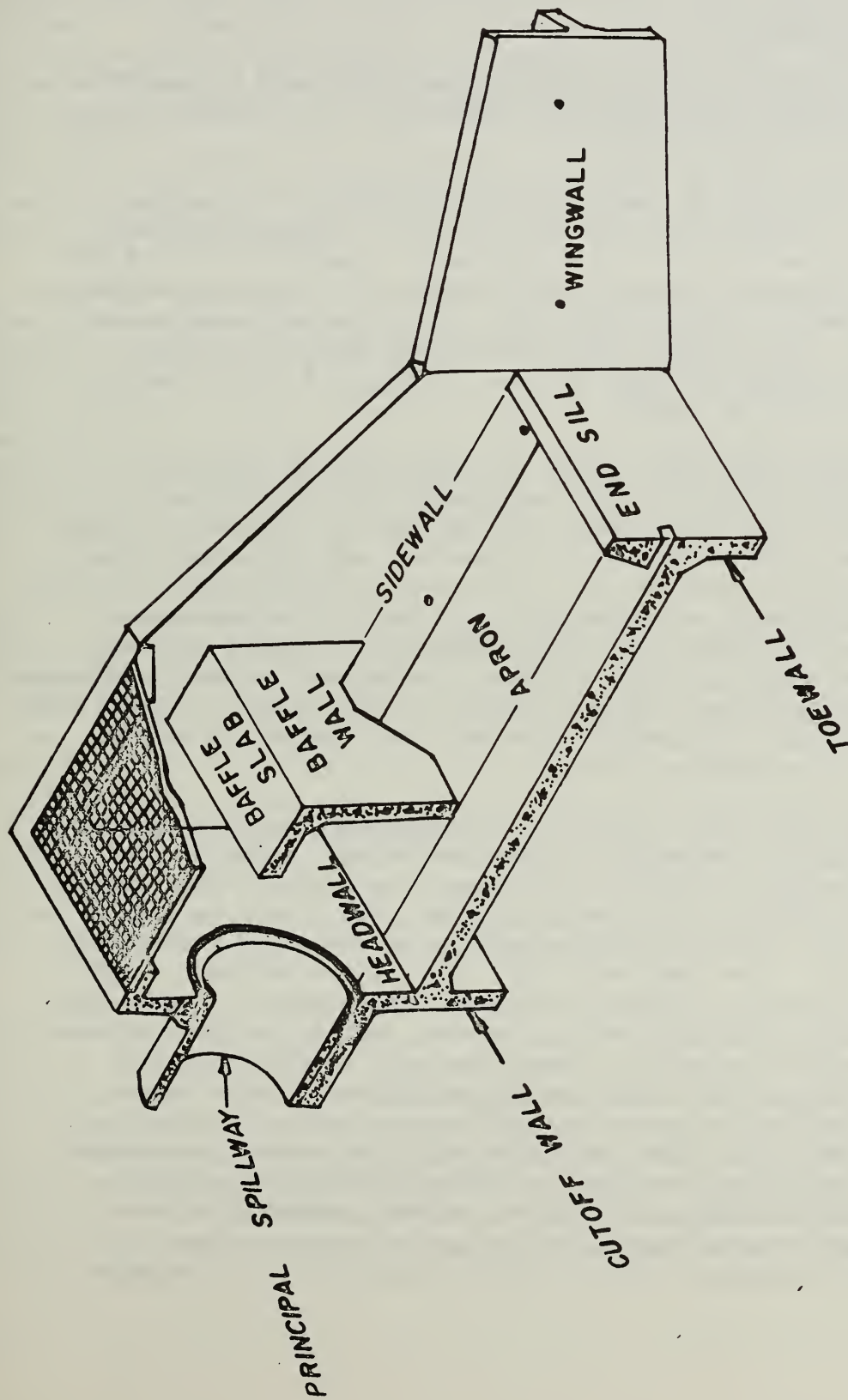
The appurtenant features for water supply consist of a concrete box intake structure with three 18-inch slide gates, and a 24-inch cast iron pipe with a cutoff valve. The three slide gates will be located at different elevations, the lower one being at the sediment pool elevation. Water from the reservoir will be discharged into a pumping station immediately below the dam. Nonproject features will consist of the raw water pumping station, a water treatment plant located nearby, and a water distribution system. The consulting engineer's report states that this site is suitable for use as a municipal and industrial water supply reservoir, and that the stored water will be adequate in both quality and quantity for this purpose.

Recreational facilities to provide for public use of this site include two boat launching ramps, two parking lots, one concession stand, a well and modern sanitary facilities at each site, picnic tables, and trash receptacles. The county will own a minimum of 50 feet around the entire shoreline, on which they plan future development of a nature trail. Safety features will include



SECTION OF PLANNED WATER SUPPLY AND
FLOODWATER RETARDING STRUCTURE

Fig. 3



SECTION OF A TYPICAL IMPACT BASIN

Fig. 4

directional and warning signs at appropriate locations around the lake. These facilities will be adequate for full use of the lake (37,100 visits annually). All facilities will be designed to provide safety for all users, and will include provisions for use by handicapped persons.

Operation and Maintenance

Land treatment measures will be operated and maintained by landowners and operators through cooperative agreements with the Piedmont Soil and Water Conservation District.

The Virginia Commission of Game and Inland Fisheries will operate and maintain the multiple-purpose structure with planned fish and wildlife development (No. 1E) at an estimated annual cost of \$78,860. Prince Edward County will operate and maintain the multiple-purpose structure with water supply storage (No. 12) at an estimated annual cost of \$2,000. The District will operate and maintain the six floodwater retarding structures (Nos. 2, 3, 4B, 5, 6, and 7) at an estimated annual cost of \$3,900.

Typical operation items will include the operation of gates for water supply (No. 12) and for flow management (all structures). Operation items for all structures will include the removal of trash and debris from the structures, appurtenances, and pool areas after floods. Maintenance items for the structures and appurtenant features may include replacement and revegetation of soil on eroded areas of the vegetated spillways or on the embankments, keeping drainage system in proper working order, repairs to gates and valves, repainting of exposed metal surfaces, and replacement of rock riprap. Vegetative maintenance includes items such as mowing, fertilizing, reseeding, weed control, and grazing control.

The Briery Creek lake (No. 1E) will be stocked with warm-water game fish by the Virginia Commission of Game and Inland Fisheries, and they will also manage the fishery. Planned fish and wildlife facilities, including fishing piers, parking areas, boat ramps, access roads, trails, and comfort stations will be operated and maintained by the Commission. The Commission will operate and maintain a public water supply system and sanitary facilities as required by state and local health laws and regulations. Sanitary facilities will include septic tanks and drain fields. Capacities will be determined by the consulting engineers using standard guidelines. Solid waste will be collected by the county or their contractor and disposed of at the county landfill. The Commission will also repair and replace equipment and facilities provided for fish and wildlife purposes, develop and enforce needed regulations, prevent pollution of the lake and adjacent areas, dispose of garbage and other refuse, and eliminate safety hazards. Public access rights-of-way to the site

have already been obtained by the Commission. The Virginia Commission of Game and Inland Fisheries operational funds will be used for operation and maintenance of this site.

The Virginia Commission of Game and Inland Fisheries will also stock the Sandy River lake (No. 12) with warm-water game fish and manage the fishery. Planned facilities to allow public use at this site, which will be operated and maintained by the county, are similar to those at site 1E. Operation and maintenance responsibilities are the same as for site 1E. Funds for operation and maintenance of the fishery resources and facilities provided for public recreation at this site will be obtained from user fees, not to exceed that amount required to defray these costs and to recover the county's initial investment.

Upon acceptance from the contractor, structural works of improvement will be operated and maintained by the project sponsors. The responsible sponsor will perform the necessary operation and maintenance utilizing his own capabilities or through arrangements with others satisfactory to the Service. However, a time period not to exceed 3 years is allowed for establishment of vegetative cover associated with each structural measure. During this time period, additional work required to obtain satisfactory vegetative cover may be performed with cost sharing at the same rate as for installation of the original works.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structure. These joint inspections will continue for three years following installation of the dam. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Soil Conservation Service employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Service representative. Any evidence of needed inspections, or improperly performed maintenance, will be reported immediately so that appropriate action can be taken by the responsible sponsor.

Specific operation and maintenance agreements will be executed prior to signing a landrights, relocation, or project agreement. In addition to specific sponsor responsibilities for nonstructural and structural project measures, these agreements will also contain specific provisions for retention and disposal of real and personal property acquired in whole or in part with P.L. 566 funds. The operation and maintenance agreements will contain a reference to the Soil Conservation Service Operation and Maintenance Handbook for Virginia, and an operation and maintenance plan will be prepared for each structure.

PROJECT COSTS

The total project installation cost is estimated to be \$6,663,250. Public Law 566 funds will provide \$3,023,550 and other funds \$3,639,700 of this amount. Total installation cost of structures is estimated to be \$5,689,350; with P.L. 566 funds providing \$2,886,250 and other funds \$2,803,100 of this amount. The following table gives a more detailed break-down of project cost.

TOTAL PROJECT COST			
	<u>P.L. 566</u> <u>Funds</u>	<u>Other</u> <u>Funds</u>	<u>Total</u>
Land Treatment	137,300	836,600	973,900
Structural Measures			
Construction	2,410,750	1,239,350	3,650,100
Other (Engineering Services, Landrights, project administration)	475,500	1,563,750	2,039,250
TOTAL PROJECT	3,023,550	3,639,700	6,663,250

ENVIRONMENTAL SETTING

PHYSICAL RESOURCES

Bush River watershed, containing 154.3 square miles (98,772 acres), lies in the eastern half of Prince Edward County, Virginia. Bush River flows in a northerly direction into the Appomattox River, a tributary of the James River. As delineated by the Water Resources Council, Bush River is in the Lower Chesapeake Bay Subregion (0208) of the Middle Atlantic Region (02) which ultimately discharges into the Atlantic Ocean. It is in Land Resource area 136, the Southern Piedmont area of the South Atlantic and Gulf Slope Cash Crop, Forest, and Livestock Region 1/. The watershed is generally typical of this area of the Piedmont Region, with a predominantly rural setting.

Farmville, county seat of Prince Edward County, borders the northwestern corner of the watershed. The communities of Kingsville, Hampden-Sydney, Green Bay, and Meherrin, even though not incorporated as towns, serve as community centers for the upper part of the project area. Richmond, the state capital, is located 65 miles to the northeast, and Lynchburg is located 62 miles to the west. Other metropolitan centers within 200 miles include Roanoke, Danville, Charlottesville, and Norfolk, Virginia; Raleigh, Durham, and Greensboro, North Carolina; Washington D.C.; and Baltimore, Maryland.

Based on 1970 census data, the present population of Prince Edward County is 14,379, with a population density of 40 people per square mile. Of these, 4,331 people live in Farmville. Approximately 3,550 people live in the Bush River project area. This population is about 38 percent rural and 62 percent urban fringe.

Climate - Temperatures in the area average about 40 degrees Fahrenheit in winter and 77 degrees in summer. Below-zero temperatures occasionally occur as overnight lows, but very few days have below-freezing temperatures of more than 24 hours' duration. Sometimes during summer hot spells, the daytime high temperature will reach 100 degrees or more, but this condition lasts for only a few days at a time. The lowest official temperature recorded in the area is 6 degrees below zero, and the highest 105 degrees above. The average growing season is about 190 days from early April to mid-October.

Annual precipitation amounts to about 42 inches, of which about 24 inches normally occurs as rain between the first of April and the last of September; the remaining 18 inches falls as rain or snow between the first of October and the last of March. Floods have been recorded in all months. Some of the most troublesome floods are caused by storms of tropical origin which occasionally

1/ Austin, Morris E., Land Resource Regions and Major Land Resource Area of the United States - Soil Conservation Service, U.S. Department of Agriculture - Agriculture Handbook 296, 1965.

pass through the area in late summer and early fall, often causing widespread flooding and damage to maturing grain and forage crops.

Topography - The topography ranges from gently-rolling to hilly and is typical of the Piedmont Physiographic Province. Elevations range from 714 feet above sea level along the headwater ridges to 290 feet at the confluence with the Appomattox River.

Soils - Groupings of soils with similar origin are called soil associations. Each soil association contains a few major soils and other minor soils in a pattern that is characteristic although not uniform. Following are brief descriptions of the soil associations shown on the general soils map of the Bush River watershed, which drains a portion of Prince Edward County, Virginia. See soils map (page II-29).

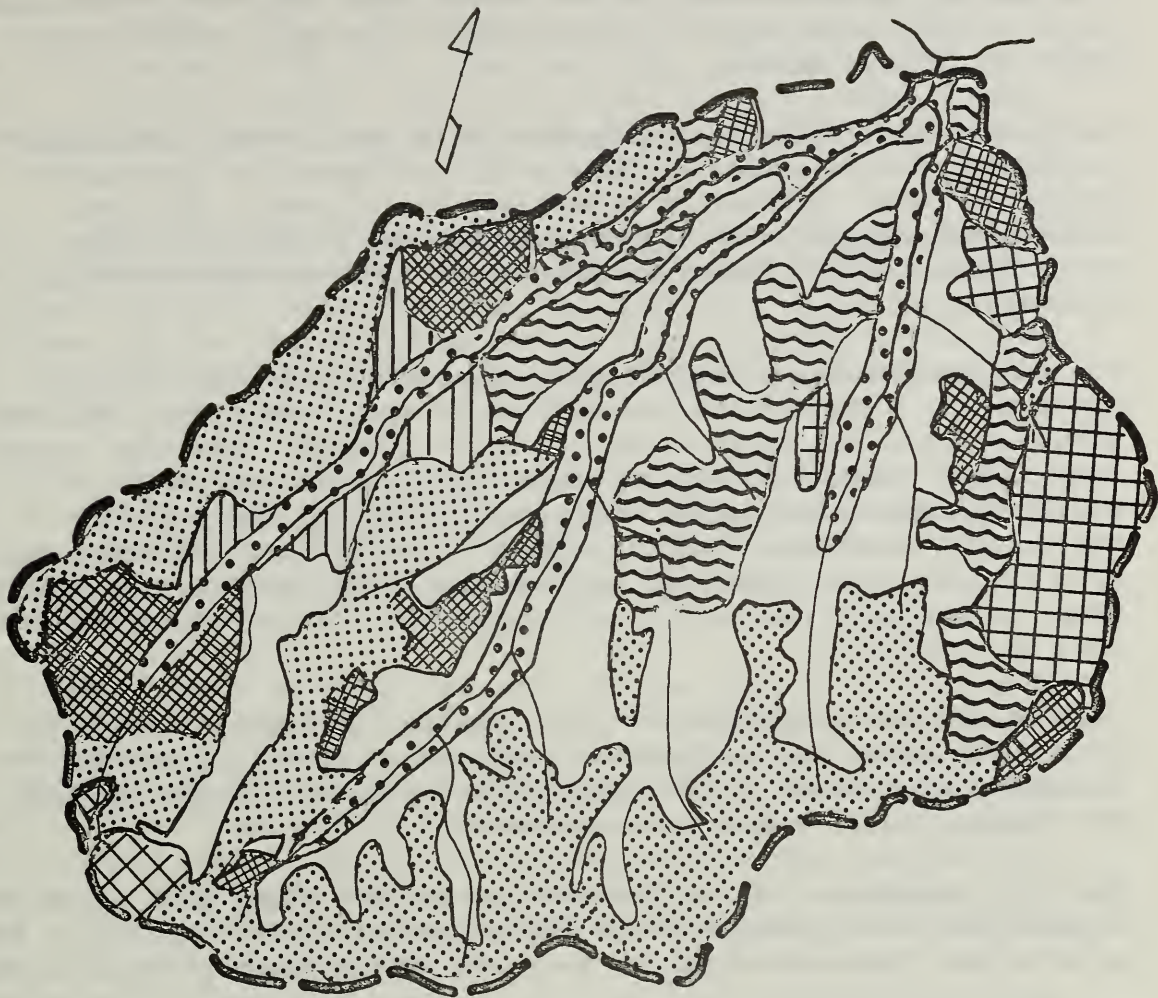
The Wilkes-Applying-Cecil association occupies much of the steep areas adjacent to the streams and their adjoining ridges. They are formed in residuum weathered from granites, gneisses, and schists. The steeper Wilkes soils are usually left in forest or pastureland. The Applying and Cecil soils are on more favorable relief and much of this land is tilled. They are responsive to fertilization and are productive soils. Good yields of corn, small grain, tobacco, and hay can be expected with good management.

The Cecil-Madison-Wilkes association is mostly in the southern part of the watershed. The Cecil and Madison soils are mostly on broad ridges and the Wilkes on steeper slopes next to drainageways and streams. They are formed in residuum weathered mostly from quartz mica schist, sericite schist and with some hornblende on steeper slopes. These soils are responsive to fertilization. They produce high yields for the major crops grown in the area such as corn, small grain, dark tobacco, and hay.

The Madison-Louisa-Cecil association is located mostly near the center of the watershed. The soils are formed in residuum weathered from quartz mica schist. These soils are responsive to fertilization and with good management produce high yields for crops common to the area such as dark tobacco, corn, small grain, and hay.

The Applying-Louisburg-Durham association is located in the eastern part of the watershed. These soils are formed in residuum from granites and gneisses. The Applying and Durham soils are among the best soils for the growth of bright tobacco and one commonly used for this purpose. The Louisburg soil is droughty and is usually left in woodland. Other crops grown on the Applying and Durham soils are corn, small grain and hay.

The Creedmoor-Mayodan-Steinburg association is in spots mainly adjacent to either side of Briery Creek. These soils were formed in residuum weathered from Triassic sandstone and shale. They are



SOIL ASSOCIATIONS ON BUSH RIVER WATERSHED

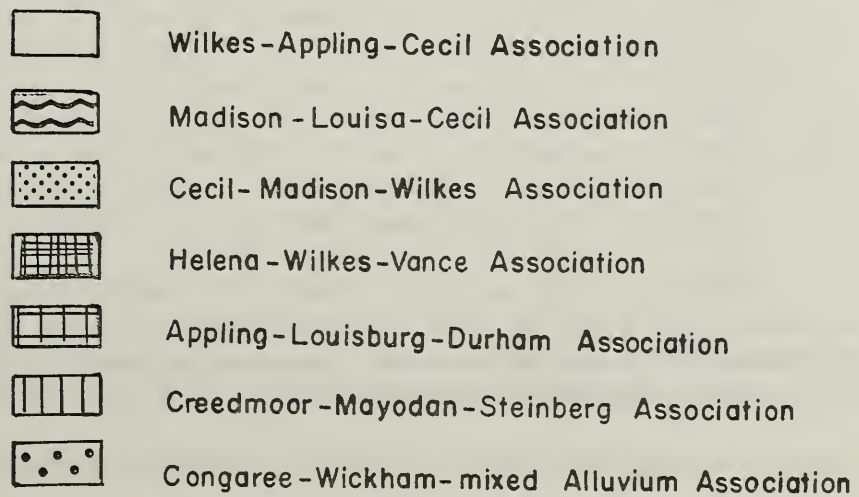


Fig. 5

moderately responsive to improved management practices. This association is used primarily for forest land and pasture with some areas in hay. The Mayodan soil is used for bright tobacco for which it is well suited.

The Helena-Wilkes-Vance association is in small areas scattered throughout the watershed. These soils are formed in residuum weathered from a mixture of acidic and basic rocks. They are moderately responsive to improved management practices. This association is used primarily for forest land and pasture with some areas in hay.

The Congaree-Wickham-Mixed alluvium association represents the soils on the flood plains and on terrace positions. They are composed of mixed sediments washed from the uplands. Drainage ranges from poorly drained to well drained. The poorly and somewhat poorly drained soils can be artificially drained where proper outlets can be found. Usually adequate outlets are available and poor drainage conditions can be improved. This association represents potentially the best agricultural land in the watershed for corn and pasture.

Land capability classification is a system for grouping soils to show suitability for agricultural purposes. It is a practical classification based on use limitations, risk of damage from use, and the way soils respond to treatment.

The U.S. Department of Agriculture has defined eight land capability classes which are designated by Roman numerals I through VIII. The hazards and limitations of use increase as the Roman numeral increases.

The Bush River watershed is composed of the following land classes by percent:

LAND CAPABILITY CLASSES

<u>Class</u>	<u>Percent</u>
I	0.0
II	30.9
III	23.5
IV	17.3
V	2.2
VI	13.0
VII	13.1
VIII	0.0
	<u>100.0</u>

The following is a description of each land capability class as stated in Soils Memorandum No. 22:

Class I - Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level 1/ and erosion hazard (wind or water) is low. They are deep, generally well-drained, and easily worked. They hold water and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

Class II - Soils in this class require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Class III - Soils in class III have more restrictions than those in class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or a combination of these items. The limitations may result from the effects of one or more of the following: (1) moderately steep slopes, (2) high susceptibility to water or wind erosion or severe adverse effects of past erosion, (3) frequent overflow accompanied by some crop damage, (4) very slow permeability of the subsoil, (5) wetness or some continuing waterlogging after drainage, (6) shallow depths to bedrock, hardpan, fragipan, or claypan that limit the rooting zone and the water storage, (7) low moisture-holding capacity, (8) low fertility not easily corrected, (9) moderate salinity or alkali, or (10) moderate climatic limitations.

Class IV - Soils in class IV may be well suited to only two or three of the common crops or the amount of harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as (1) steep slopes, (2) severe susceptibility to water or wind erosion, (3) severe effects of past erosion, (4) shallow soils, (5) low moisture-holding capacity, (6) frequent overflows accompanied by severe crop damage, (7) excessive wetness with continuing hazard of waterlogging after drainage, (8) severe salinity or alkali, or (9) moderately adverse climate.

Many sloping soils in class IV in humid regions are suited for occasional but not regular cultivation. Some of the poorly drained, nearly level soils placed in class IV are not subject to erosion but are poorly suited to intertilled crops because of the time required

1/ Some rapidly permeable soils in Class I may have gentle slopes.

for the soil to dry out in the spring and because of low productivity for cultivated crops. Some soils in class IV are well suited to one or more of the special crops, such as fruits and ornamental trees and shrubs, but this suitability itself is not sufficient to place a soil in class IV.

Land Limited in Use - Generally Not Suited for Cultivation

Class V - Soils in this class have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations. Examples of class V are (1) soils of the bottomlands subject to frequent overflow that prevents the normal production of cultivated crops, (2) nearly level soils with a growing season that prevents the normal production of cultivated crops, (3) level or nearly level stony or rocky soils, and (4) ponded areas where drainage for cultivated crops is not feasible but where soils are suitable for grasses or trees. Because of these limitations cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected.

Class VI - Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing and water control with contour furrows, drainage, ditches, diversions, or water spreaders. Soils in class VI have continuing limitations that cannot be corrected, such as (1) steep slope, (2) severe erosion hazard, (3) effects of past erosion, (4) stoniness, (5) shallow rooting zone, (6) excessive wetness or overflow, (7) low-moisture capacity, (8) salinity or alkali, or (9) severe climate. Due to one or more of these limitations these soils are not generally suited for cultivated crops. But they may be used for pasture, range, woodland, or wildlife cover or some combination of these.

Some soils in class VI can be safely used for the common crops provided unusually intensive management is used. Some of the soils in this class are also adapted to special crops such as sodded orchards, blueberries, etc., requiring soil conditions unlike those demanded by the common crops. Depending upon soil features and local climate the soils may be well or poorly suited to woodlands.

Class VII - Physical conditions of soils in class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water-control measures such as contour furrows, ditches, diversions, or water spreaders. Soil restrictions are more severe than those in class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or

alkali, unfavorable climate, or other limitations that make them unsuited for common cultivated crops. They can be used safely for grazing or woodland or wildlife food and cover, or some combination of these under proper management.

Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland. They are not suited to any of the common cultivated crops; in unusual instances, some soils in this class may be used for special crops under unusual management practices. Some areas of class VII may need seeding or planting to protect the soil and to prevent damage to adjoining areas.

Class VIII - Soils and land forms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible.

Limitations that cannot be corrected may result from the effects of one or more of the following: (1) erosion or erosion hazard, (2) severe climate, (3) wet soil, (4) stones, (5) low moisture capacity, and (6) salinity or alkali.

Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in class VIII. It may be necessary to give protection and management for plant growth to soils and land forms in class VIII in order to protect other more valuable soils, to control water, or for wildlife or esthetic reasons.

LAND USE BY LAND CAPABILITY CLASSES IN TOTAL WATERSHED

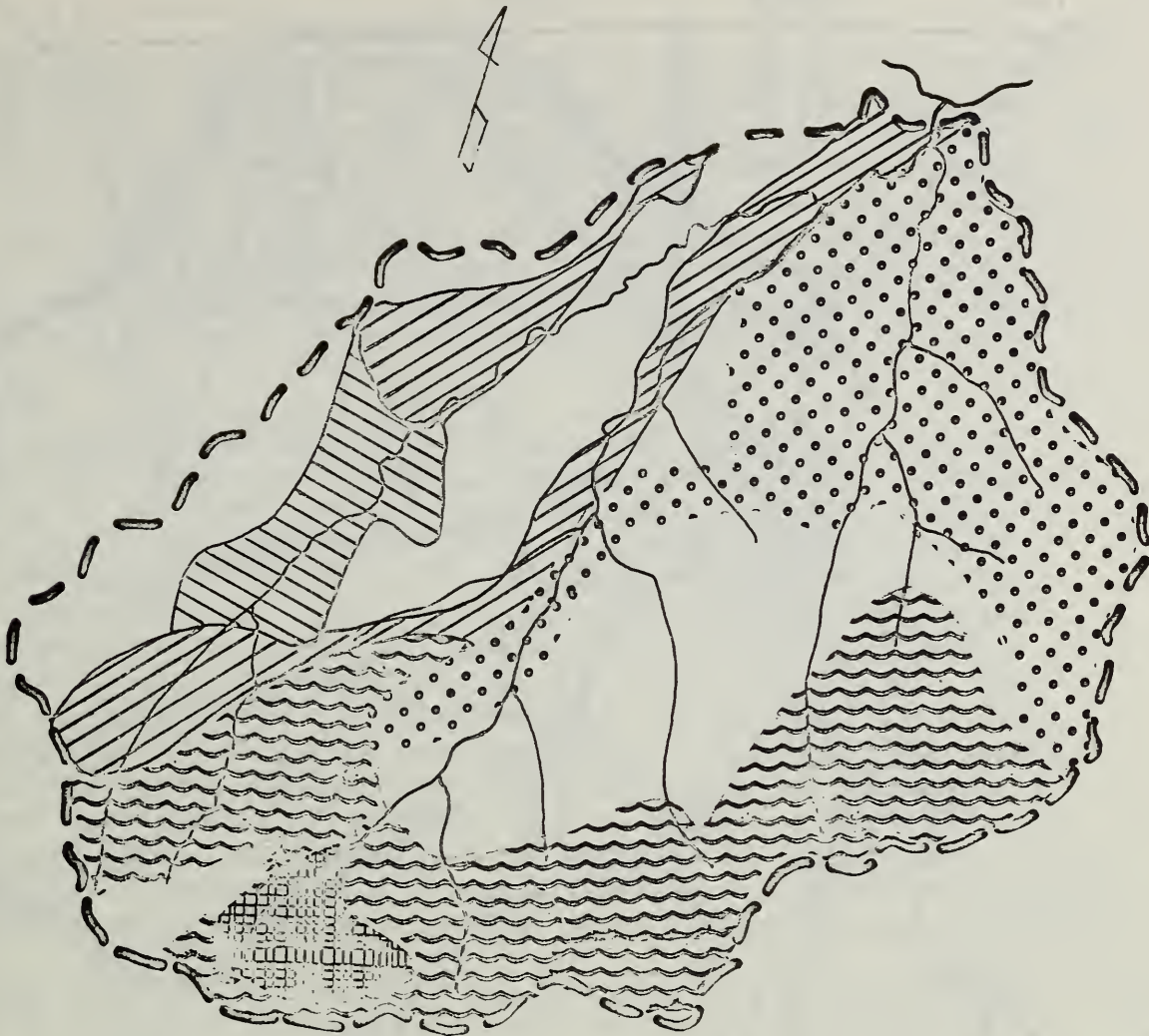
Land Capability Class	% of Total in each Class	Acres in Each Use				Total Acres
		Cropland	Pasture- land	Forest Land	Other	
I						
II	30.9	3,448	2,429	23,578	1,057	30,512
III	23.5	1,779	2,271	18,592	577	23,219
IV	17.3	1,331	1,513	14,218	54	17,116
V	2.2	56	268	1,857	35	2,216
VI	13.0	397	1,012	11,143	253	12,805
VII	13.1	693	1,792	10,123	296	12,904
VIII						
Total Acres		7,704	9,285	79,511	2,272	98,772
% of Total In Each Land Use		7.8	9.4	80.5	2.3	100.0

Geology - The area drained by Bush River is underlain by sedimentary, igneous and metamorphic rocks. The sedimentary rocks are Triassic sandstone and shale of the Newark Group. These rocks underlay a small area in the vicinity of dam 1E in the western part of the watershed. The igneous rocks are the Columbia granite of Precambrian age which underlies about 50 percent of the watershed and scattered Triassic diabase dikes in the west. The metamorphic rocks mainly lower Paleozoic and Precambrian schists and gneisses underlay most of the lower half of the watershed.


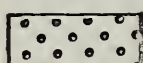
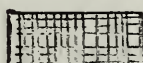



Prince Edward County is one of the major producers of kyanite, a refractory mineral, in the United States. Deposits of kyanite are reported at Leigh Mountain in the Bush River watershed but none is being mined at present.

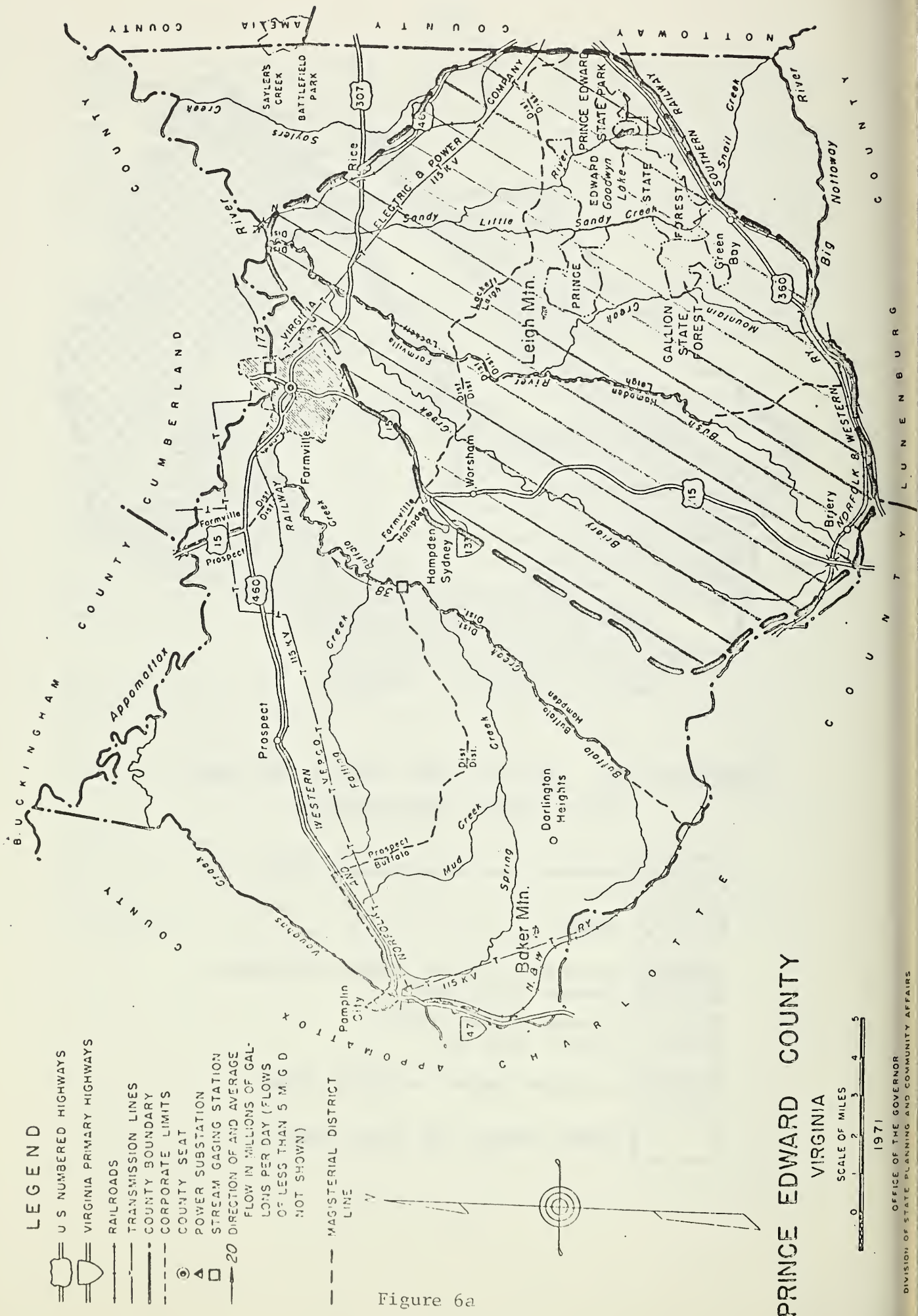
Mineral Resources - Prince Edward County - During 1970, kyanite-bearing quartzite was mined at Baker Mountain, near Darlington Heights and processed for kyanite. A grinding and bagging plant is located at Pamplin City for the kyanite from Baker Mountain. The processed kyanite and a calcined product known as mullite, which is made from the kyanite, is marketed primarily for refractory and ceramic purposes. Quartz sand recovered during the processing of the kyanite is marketed for construction and industrial purposes. Magnetic iron oxide is recovered during the processing operation and stockpiled. Other occurrences of kyanite are found east of Worsham at Leigh Mountain, north of Briery, and south of Prospect.

In the past, granitic rocks have been quarried near Farmville for use as crushed stone, and near Rice for use as building stone. Feldspar has been mined from pegmatite near Prospect, and several mica and feldspar prospects have been opened in pegmatites in the area between Prospect and Darlington Heights. Clay has been produced near Farmville for use in the manufacture of brick, and clay materials at other localities are potentially useful for ceramic products. Sand and gravel have been produced for use in local highway construction and maintenance. Thin seams of bituminous coal, which may be locally altered to coke, occur near Farmville. Monazite, a phosphate of rare earths, occurs in saprolite derived from granitic rocks near Hampden-Sydney and Tuggle. Vermiculite is reported to occur near Darlington Heights.



GENERALIZED GEOLOGY AND ROCK TYPE MAP BUSH RIVER WATERSHED

-  Sandstone and Shale Triassic Basin
-  Granite
-  Greenstone, Chlorite Schist, Metagabbro, Carolina Slate Belt
-  Chlorite, Sericite, Schist, Carolina Slate Belt
-  Hornblende Gneiss, and Mica Gneiss
-  Granite Gneiss and Mica Schist



Ground Water - Prince Edward County ^{1/} The bedrock in the watershed is covered by 25 to 70 feet of unconsolidated soil, alluvium and weathered rock. Ground water occurs in the lower portion of the unconsolidated material; in fractures and weathered zones within the bedrock; the flood plain alluvial deposits that extend below the water level of the streams; and in the more permeable sandstone, shale, and metamorphic rocks. Most of the water-bearing zones in the igneous and metamorphic rocks occur within the upper 250 feet. The depth to the water table averages about 45 to 50 feet.

Most of the drilled wells are less than 200 feet deep and yield less than 20 gallons per minute. Yields of up to 50 gallons per minute are not uncommon and in rare instances wells may produce over 100 gallons per minute. The most productive well reported in the county was drilled at Hampden-Sydney College in 1969. This well was drilled to a depth of 236 feet and produces 115 gallons per minute. Another well at this school produces 75 gallons per minute. The total estimated volume of water used from four wells supplying this system was 75,000 gallons per day in 1971. It may be possible to obtain more than 100 gallons per minute from single wells at selected sites elsewhere in the county, but in many areas it will be necessary to drill two or more wells to obtain this amount of water. The best sites for drilling are generally in areas at low elevation near perennial surface drainage. The least productive sites are likely to be on sharp-crested ridges or hills.

Springs and dug wells formerly supplied most of the ground water used in the county, and many are still being used. Springs are more numerous and productive in the western half of the county. Dug wells are normally 50 to 60 feet deep and yield small quantities of water for farm and domestic use. Because of the generally low yields from dug wells and springs, the decrease of yields during periods of drought, and the susceptibility to surface contamination, these shallow sources of water are being replaced by drilled wells.

Quality of the ground water varies with the type of bedrock and depth of the wells. Excessive iron or hardness is reported in some areas, especially those underlain by shale, sandstone, and some metamorphic rocks. Part of the iron content in some water supplies may be the result of acidic water corroding metal in the pipe system. Water from near the upper surface of the bedrock is often less mineralized than water from deeper within the bedrock.

Surface Water Resources - Bush River has its origin in the southern most portion of the watershed where Prince Edward County, Charlotte County, and Lunenburg County border each other. It is a perennial

^{1/} Data Summary - Prince Edward County, Virginia Division of State Planning and Community Affairs, June 1971.

stream with numerous intermittent and perennial streams feeding it. The river flows in a northerly direction to the confluence with the Appomattox River. The watershed is generally oblong in shape and is about 17 miles long and 11 miles wide.

Other perennial streams in the watershed and tributary to Bush River are Horsepen Creek, Evans Branch, Goodes Branch, Camp Creek, Rice Creek, Mountain Creek, Redd Branch, Cunninghams Creek, Millers Creek, Briery Creek, and Sandy River.

The principal existing surface water resources are limited to Prince Edward and Goodwin lakes located within the Prince Edward-Gallion State Forest on the headwaters of Sandy River. These lakes provide fishing throughout the year. Many farm ponds also provide fishing for the owners and their guests.

The waters of Bush River are of good quality. Dissolved oxygen levels are high indicating little organic pollution. Fecal coliform counts are low and nutrient levels remain well within the parameters set for a free flowing stream. Water in the "Appomattox River from the head of tidal waters, and free flowing tributaries to the Appomattox River, to their headwaters" is classified as III-A by the State Water Control Board 1/. The Board's quality classification of III-A indicates that Bush River is a "free flowing stream (Coastal Zone and Piedmont Zone to the Crest of the Mountains)" with "waters generally satisfactory for use as public or municipal water supply, secondary contact recreation, propagation of fish and aquatic life, and other beneficial uses" 1/. See Appendix G for temperatures and other water sample data.

Wetlands - Approximately 290 acres of Type 1 and 2 wetland 2/ is located within the watershed. Thirty-eight acres are located in the permanent pool area of site 1E on Briery Creek; 18 acres in site 12 on Sandy River, and 2 acres each in sites 5 and 6 on Camp and Evans Creeks, respectively. The remaining 230 acres will not be affected by the project.

1/ Virginia State Water Control Board, 1974, Commonwealth of Virginia Water Quality Standards.

2/ Shaw, S. P., and Fredine, C. G., 1956. Wetlands of the United States. United States Department of the Interior, Fish and Wildlife Service Circular 39.

Land Use - Currently, 79,511 acres (80.5 percent) of the watershed is in forest land, 9,285 acres (9.4 percent) is in pastureland, 7,704 acres (7.8 percent) is in cropland, and about 2,272 acres (2.3 percent) is in other uses such as buildings, roads, utilities, and odd areas. All of the Prince Edward-Gallion State Forest (6,936 acres) and 2,800 acres of forest land owned by the Virginia Commission of Game and Inland Fisheries is within the watershed boundary and is included in the above acreage figures. All of the remaining forest land is in private ownership with approximately 25 percent of the private ownership by forest products using industries. There are approximately 450 private landowners on this watershed.

Hardwood bottom lands are covered with water whenever flooding occurs. This may last for a few hours, or up to 3 or 4 days, depending on storm duration. Currently 31 percent of the flood plain below the proposed structures is in crops and pasture. Principal crops grown in these flood plains and surrounding uplands are corn, small grain, soybeans, tobacco, silage, pasture, and hay.

PRESENT AND PROJECTED POPULATION

According to the U.S. Bureau of the Census 1/, the 1970 population of Prince Edward County was 14,379; of which 4,331 resided in the town of Farmville. The county's population was relatively stable, at about 14,700 to 15,400 from 1920 to 1950 1/. There was a decline of about 8.3 percent from 1950 to 1960; but since then there has been a steady increase with the July 1, 1973 population estimated at 14,800 by the Tayloe Murphy Institute of the University of Virginia. Medium range population projections for the county indicate a population of 15,800 by 1980 and 16,900 by the year 2000 2/. High range population projections based on the State River Basin Water Quality Plan 3/, indicates the population increasing from 14,379 in 1970 to 23,000 in 2020.

Projections by age group made for the Virginia Division of State Planning and Community Affairs indicate an increase of about 40 percent in the number of people between the ages of 20 and 65 between 1970 and 1980. Most of the population growth is expected to take place in the areas to be served by the planned expansion of the public water and sewer systems. This will encourage population centers which can be efficiently serviced with water and sewer services and other necessary utilities, and at the same time retain relatively large areas of the county in a rural environment.

ECONOMIC RESOURCES

Public lands in the Bush River watershed consist of about 6,936 acres of state owned land in the Prince Edward-Gallion State Forest and 2,800 acres owned by the Virginia Commission of Game and Inland

1/ U.S. Bureau of the Census; Population, 1920, 1930, 1940, 1950, 1960, and 1970.

2/ Population Projections, Virginia Counties and Cities 1980 -2000, Virginia Division of State Planning and Community Affairs, March 1975.

3/ Virginia State Water Control Board Planning Bulletin 269, James River Basin, 1972.

Fisheries in the headwaters of Briery Creek. All remaining land except that in highway rights-of-way is in private ownership.

Agriculture is the major industry in the watershed. The major agricultural enterprises are dairy, livestock, and field crops (chiefly tobacco, corn, wheat and soybeans). Presently forest stands including the state owned land, occupy approximately 80 percent of the watershed area. There is a good demand for pulpwood, sawtimber, and veneer logs at nearby concentration yards and saw-mills.

There are 445 farms in the watershed, ranging from less than 10 acres for some of the smaller part-time operations to 1,666 acres for the largest commercial farm in one ownership. The average size is about 156 acres.

Production levels for crops grown in the watershed reflect the flood hazard and the necessity of using marginal upland for some crops. Current production levels per acre are 40 to 125 bushels of corn, 10 to 20 tons of silage, 1 to 5 tons of hay, 25 to 50 bushels of wheat, and 15 to 25 bushels of soybeans. Pasture provides 2 to 6 animal-unit-months of grazing per acre. With the existing flood hazard, the bottom land soils average about 80 bushels of corn, 15 tons of silage, 30 bushels of barley, 2.5 tons of hay, 3 animal-unit-months of grazing, and 20 bushels of soybeans.

Until recent years sale of field crops provided most of the farm income in this area. With increased interest in dairy, livestock, and poultry production since the late 1950's farm income from these sources has steadily increased. The 1969 Census of Agriculture indicates that approximately 60 percent of the farm income was derived from the sale of dairy, livestock, poultry, and their products; 37 percent from field crops and nursery stock; and about 3 percent from the sale of forest products, fruit, vegetables, and other miscellaneous products.

Farm ownership by operators increased from 55.7 percent in 1964 to 74.1 percent in 1969. During this period the proportion of part-owners decreased from 30.7 percent to 19.0 percent and tenant-operated farms decreased from 13.5 percent to 6.9 percent. In 1969, 82.6 percent of the farms were classified as individual or family farms, 15.6 percent as partnerships, and 1.8 percent in cooperation and "other" types such as institutional, research, reservations, etc.

Of the 445 farms, 132 are classified as part-time operations, and 112 as part-retirement farms, with the remaining 201 being full-time operations. A part-time farm operation is described in the

U.S. Census of Agriculture as one in which annual gross sales were less than \$2,500 and the operator was under 65 years of age and worked more than 100 days off-farm during the census year. A part-retirement farm is described as one in which the value of farm products sold was less than \$2,500 and the operator was 65 years of age or older.

Most of the farms are single family, owner-operated units with day-labor hired as needed. A few of the larger operations have full-time employees who live on the farm and are paid a monthly salary. About 4 percent of the cropland is operated on a share of crop basis. This type of operation is primarily related to production of tobacco on about 25 farms in this watershed.

Land values, exclusive of buildings, currently range from \$350 to \$2,500 per acre depending on the use, location, accessibility, availability of utilities, and development costs. Flood plain land values are usually estimated at about \$350 per acre for agricultural use when included as a part of tracts with usable upland.

The major forest types are hardwood, 46 percent; pine-hardwood, 32 percent; and pine, 22 percent. The hardwood type stands include several species of oak along with poplar, hickory, gum and sycamore. The pine type includes pure and mixed stands of Virginia and short-leaf pine and loblolly pine plantations. These stands are 29 percent sawtimber, 47 percent pole size timber, and 24 percent seedling and sapling size stands. When considering desirable species, 66 percent of the stands are well stocked, 22 percent medium stocked and 12 percent poorly stocked. There is a good demand for quality sawlogs, veneer logs and pulpwood at nearby forest products using industries. Given protection, care, and management the forest stands will contribute to the future economy of the watershed.

Manufacturing, a major source of employment in the county, is primarily centered in the Farmville area, with some sawmills and similar establishments scattered throughout the county. These industries include lumber, millwork, shooks, staves, flour and feed, dairy products, shoes, women's and children's clothing, printing, tobacco, and electronics. Construction, services, commercial trade and educational institutions also provide considerable employment opportunities in this area. Employment in agriculture has declined steadily for several decades and in 1970 constituted only slightly over 10 percent of all employment in the county.

In 1960 the civilian work force constituted 36.1 percent of the total population. By 1970, the work force constituted 49.0 percent of the total. During this period unemployment ranged from 2.1 to 1.5 percent.

The 1970 U.S. Census reported per capita income in Prince Edward County at \$2,225, compared to \$3,013 for the state of Virginia. Family income in Prince Edward County averaged \$5,137 in 1970 compared to \$10,568 for the state. Almost 28 percent of the families had less than \$4,000 annual income, compared to 16.2 percent of all families in the state.

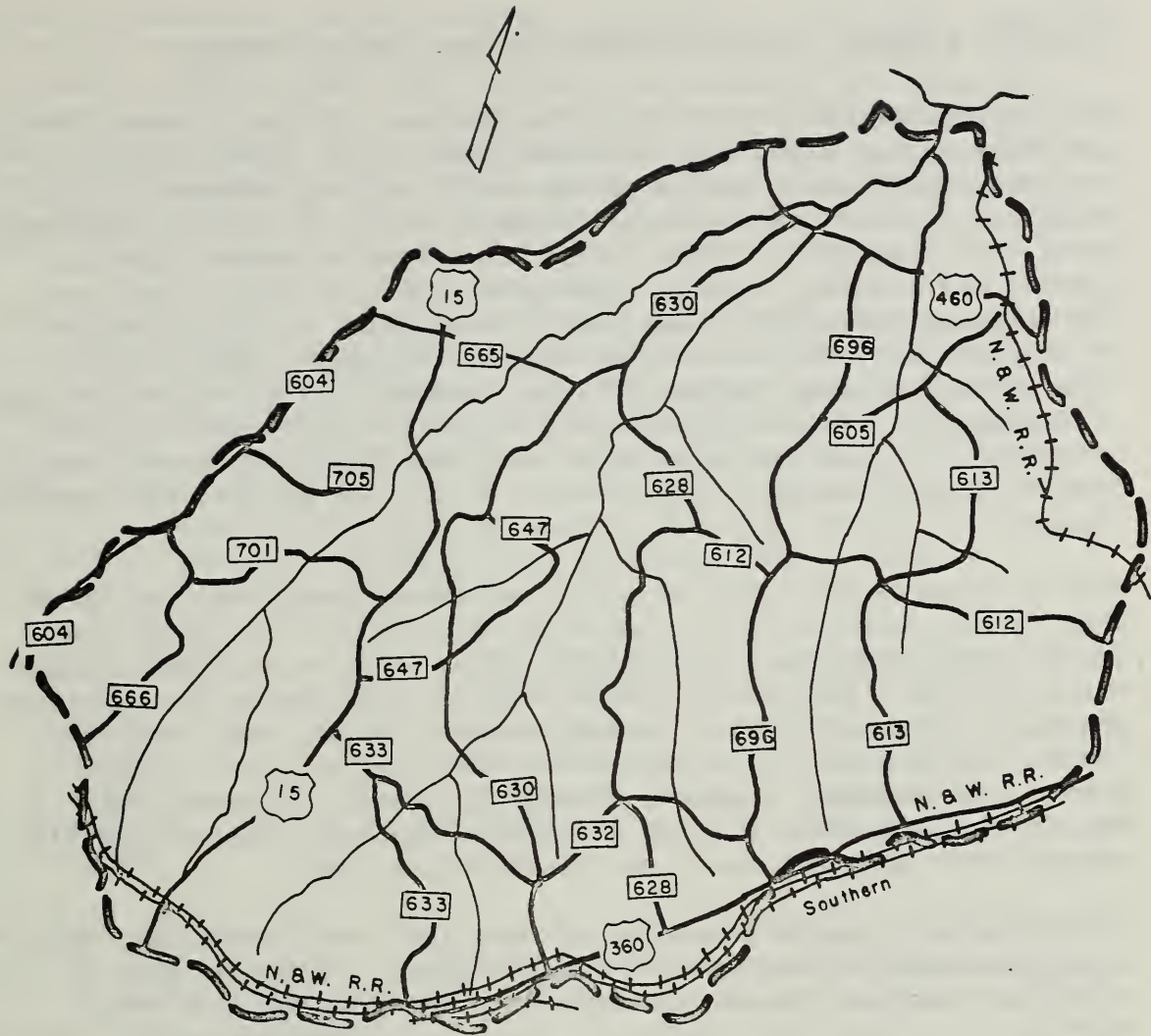
The 1964 Census of Agriculture reported 77.6 percent of the farms in Prince Edward County had less than \$5,000 gross sales. This situation showed only very slight improvement in 1969 when 74.9 percent of all farms reported gross sales of less than \$5,000.

Any area of the watershed is easily reached from a network of public and private roads. Three national primary highways serve the watershed along with a well distributed network of all-weather state roads. U.S. Highway 360, the main arterial highway between Richmond and Danville, traverses the headwaters of Sandy River and Bush River. U.S. Highway 460 from Norfolk to western Virginia and the mid-continent area passes through the northern area of the watershed. A main north-south highway through central Virginia, U.S. Highway 15, passes through the western area of the watershed, intersecting with U.S. Highway 460 in Farmville and U.S. Highway 360 about 1.75 miles south of the headwaters of Briery Creek.

Motor freight transportation is available daily throughout the area with connections to all parts of the nation. Rail service is available from two major railroads. The main line of the Norfolk and Western Railway Company passes through the north-eastern area of the watershed, with freight service available at Farmville. The Southern Railway Company's Richmond-Danville branch crosses the southwestern corner of the watershed with freight service at Green Bay and Briery. Eastern Greyhound Lines serve Farmville with frequent daily passenger bus schedules. These schedules provide connections at Roanoke, Lynchburg, and Richmond to all parts of the nation.

A private landing strip is located near U.S. Highway 460 along Sandy River. This facility presently has a 3,400-foot sod runway which will accommodate small aircraft. The Farmville Municipal Airport is located about 5 miles northwest of Farmville in Cumberland County. This airfield has a 3,200-foot surfaced runway which can be extended to 6,000 feet, if needed, and was planned to serve Farmville and Prince Edward and Cumberland Counties. The nearest airport offering commercial service is at Lynchburg, about 50 miles to the west.

Electricity and telephone service is provided to all parts of the watershed. These and other public utility plans are continually reviewed and facilities added, as needed to provide for demands.



TRANSPORTATION SYSTEMS BUSH RIVER WATERSHED

Fig. 7

PLANT, ANIMAL AND RECREATIONAL RESOURCES

Bush River watershed supports a wide variety of plant communities. Currently 79,511 acres are in forest land, 7,704 acres are in cropland, 9,285 acres are in pastureland, and approximately 2,272 acres are in other uses such as homes, yards, odd areas, buildings, roads, and utilities. Plant communities such as annual plants, grasses and legumes, shrubs, hardwoods, and coniferous trees provide elements of wildlife habitat. Terrestrial wildlife habitat is based on the quality and quantity of the plant communities. This watershed has a variety of plant communities in various stages of succession. The cropland is well distributed throughout the watershed. It provides a variety of plants including annual weedy plants, grain, and seed crops, and a variety of grasses and legumes for hay.

Annuals require bare soil on which to become established and grow. They develop seed in great abundance, and most of the seeds are durable and long lived. Therefore, annual plants provide valuable wildlife food. The most valuable wildlife food among the cultivated annuals is corn, followed closely by wheat, milo, oats, and soybeans. Among the wild annuals which provide food are barnyard grass, lambsquarter, ragweed, foxtail, pigweed, chickweed, and smartweed. Approximately 540 acres are idle each year and provide ground cover and some weed seed for wildlife food.

Characteristic wildlife species of open land are blackbirds, meadowlarks, mourning doves, sparrows, and finches. Other species of wildlife which use open, cultivated, or weedy areas, but which depend on a mixture of vegetative types, are bobwhite quail, cottontail rabbits, gray fox, shrews, and meadowmice.

Grasses and legumes planted for hay are a very important element of wildlife habitat. They provide nesting and contrasting types of dense, low wildlife cover and furnish food for a wide variety of mammals and birds in particular situations. There are a very few spots in the watershed where grasses represent the climax vegetative community. Therefore, whether natural or planted, grasses and legumes make up a very unstable and short-term plant community unless well cared for.

Practically all grasses and legumes used for pasture have value for erosion control and some value for wildlife. Fescue, bluestem, and orchardgrass provide nesting areas for field sparrows, meadowlarks, bobwhite quail, cottontail rabbits, meadowmice, and short-tailed shrews. These as well as whitetailed deer, wild turkeys, and groundhogs feed on the tender growth of a wide variety of grasses and legumes as well as the associated small seeds and insects. Grass and legume areas are more valuable and useable to wildlife if woody vegetation is nearby.

Within the watershed, shrubs become a component of the plant community during the process of succession. This is a natural process which is continuously taking place when logging and clearing for agronomic crops are substituted for the natural forest. The shrubs occur in abandoned farm fields following the annuals and mixed herbaceous plants. The shrubs are also found in the forest land, forming distinct layers under the trees. Usually, different shrub species are found in these two situations.

In the shrub stages of plant succession, there is considerable variation in the ability of different species to maintain themselves. Some, such as dewberry, blackberry, and raspberry have a relatively short period of dominance. They are eventually replaced by honeysuckle, sumac, elders, hazelnut, and other species which are intermediate in span of dominance. Flowering dogwood, hawthorn, and redbud are late-stage plants that persist in abundance even after trees have become dominant. Shrubs in the watershed seem to fall in successional categories, as follows:

<u>Early Stages</u>	<u>Mid Stages</u>	<u>Late Stages</u>
wild rose	honeysuckle	flowering dogwood
dewberry	hazelnut	hawthorn
blackberry	poison ivy	redbud
blueberry	sumac	spicebush
huckleberry	elder	shadbush

Many forms of wildlife in the watershed find the shrubs a valuable source of food and cover. Included are the whitetailed deer, ruffed grouse, bobwhite quail, woodchucks, jays, thrashers, robins, cardinals, and cedar waxwings.

Trees occupy the final stage of plant succession in this watershed. They have a high degree of stability, and major changes are relatively slow unless the forest cover is disrupted by man's activities such as logging, burning, or grazing. Trees which provide dens, nest sites, seeds, fruits, buds, and nuts are valuable for a wide variety of wildlife species. The eastern red cedar and loblolly, shortleaf, and Virginia pines provide habitat for thrushes, pine warblers, whitetailed deer, gray squirrel, eastern chipmunk, mice, and cottontail rabbits. Mixtures of conifers and hardwoods such as oaks, hickory, black walnut, holly, wild cherry, and ash are more valuable to wildlife than pure stands of any single tree species. Wildlife associated with the mixed coniferous and hardwood forest are ruffed grouse, whitetailed deer, opossum, raccoon, gray fox, gray squirrel, brown thrasher, cardinal, woodpecker, wood thrush, and red-eyed vireo. See Appendix E for lists of flora and fauna commonly found in the watershed.

Bush River, Sandy River, and Briery Creek, collectively referred to as the Bush River watershed, are typically small warm water Piedmont streams. With the exception of Briery Creek, which is a fair fishing stream, the streams are small and do not support significant numbers of catchable size fish. Bush River and its tributaries are streams that support good pickerel fishing in the lower reaches. Other sport species present include smallmouth and largemouth bass, bluegill, pumpkinseed sunfish, and bullheads. Fish collections made in cooperation with the Virginia Commission of Game and Inland Fisheries Biologists and the Soil Conservation Service Biologist in 1973 and 1974 found a total of 39 species. For a complete list of all fish collected, including nongame species, see Appendix E.

Stream bottoms in Bush River watershed are sand mixed with silt. The upper reaches of the tributaries consist of riffles and small pools. The riffles are created by gravel bars, and on occasion bottoms of sand and large smooth rocks. Approximately 90 percent of the water areas in the streams are well shaded. The banks are covered with ironwood, red oak, red maple, river birch, blackgum, American beech, sycamore, and red ash. Understory includes eastern redbud, poison ivy, pawpaw, spicebush, wild rose, blackberry, black willow, speckled alder, sedge, and sawgrass. Benthic organisms were collected over all types of bottom materials. Species collected include water spiders, fresh water snails, fingernail clams, crayfish, and 13 genera of aquatic insects in 11 different families. Aquatic insects such as mayflies indicate good water quality, capable of producing and sustaining higher forms of aquatic life. Reptiles and amphibians such as bullfrogs, leopard frogs, green frogs, northern water snakes, northern black racers, eastern box turtles, and red-spotted newts have been observed. An observation was made on August 30, 1973, while collecting fish on Briery Creek of a nest of common snapping turtles which had hatched and the snapping turtles were entering the stream. Although never seen, there was obviously a large population of the spring peepers from the sounds heard. Also never seen, but known in the area is the copperhead. Refer to Appendix E for a listing of biota.

Fishing pressure on Briery Creek was moderate and light on Bush and Sandy Rivers. Observation indicates only moderate to low frequency of angler success. Public access was limited primarily to where bridges crossed the various streams. Prince Edward and Goodwin lakes (see Sandy River map) are located within the Prince Edward-Gallion State Forest on the headwaters of Sandy River. Fishing is permitted throughout the year on both lakes, however, the facilities are seasonal. Largemouth bass, bluegill, and crappie are the most commonly caught fish in both impoundments.

Farm ponds provide considerable fishing for the owners and their guests, and attract waterfowl as a side benefit. During the waterfowl spring and fall migrations, species observed were mallard, black, wood ducks, and an occasional Canada goose. Wild mallards occasionally nest in grassy areas around farm ponds, and wood ducks will use hollow trees or nest boxes when available. Other than the 60-odd farm ponds and reservoirs in the watershed, suitable waterfowl habitat is virtually absent except for wood ducks.

Vegetative cover for wildlife in this watershed consists of forest, pasture, abandoned fields, and cropland. The whitetailed deer harvest in Prince Edward County is slightly less than one deer per square mile. The wild turkey harvest is less than 1 bird per every 10 square miles. Hunting pressure on cottontail, bobwhite, gray squirrel, mourning dove, woodcock and ruffed grouse has been light and there are no records for this watershed area on their harvest. Beaver dams, both active and abandoned, are common throughout the watershed. These in turn have supported other species, such as the chain pickerel, frogs, turtles, muskrats, and wood ducks. Other furbearers in the county include raccoon, eastern chipmunk, opossum, woodchuck, red and gray fox and various species of mice and voles. An occasional mink and river otter will travel the waterways, and the black bear is found in the more remote areas of the surrounding mountains. Other species expected or observed within the project area include: redbellied, marsh, and sparrow hawks; screech, barn, and great horned owls; black and turkey vultures; downy woodpecker; crow; bluejay; and approximately 40 species of passerine song birds. (See Appendix E).

There are no known threatened or endangered plant or animal species in the Bush River project area.

ARCHEOLOGICAL, HISTORICAL, AND UNIQUE SCENIC RESOURCES

A careful check and review of the National Register of Historic Places revealed that two places are listed for the watershed area:

Worsham-Debtors Prison, on U.S. Highway 15.
Briery Vicinity, Briery Church, 0.3 mile north of intersection of State Routes 747 and 671.

One place is listed just outside the watershed:

Hampden-Sydney College Historic District, bounded approximately by the campus of Hampden-Sydney College.

The Virginia Historic Landmarks Commission was consulted and they made a map study and conducted an investigation. The following information on places of historic interest was given:

Chestnut Hill - located off State Route 630. No specific information given.

Falkland - A late 18th century frame house located on State Route 632. The Commission intends to nominate this structure to the National Register of Historic Places.

Linden - A late 18th century frame house located off State Route 630. (This house has been torn down and removed according to the local District Conservationist.)

The State Archeologist's report shows there are no archeological or historical resources that will be adversely affected by the project.

The National Park Service was notified with respect to the project in compliance with the National Historic Preservation Act of 1960 (80 Stat. 915) and Public Law 93-291, 86th Congress S. 1185, 1970.

The scenic values of the watershed are those of a pleasant rural environment, typified by low rolling hills covered by deciduous and mixed pine forests, interspersed by crop and pasture land.

Prince Edward County claims two of Virginia's oldest colleges. Hampden-Sydney College was established in 1776. Longwood College in Farmville is successor to a series of institutions which began in 1835, which was the first teacher-training college in Virginia and became state supported in 1884.

In the Revolutionary War the British cavalryman, Tarleton, was active in this area, raiding for supplies and burning some homes. Patrick Henry lived here from 1786 to 1794 and represented Prince Edward in the General Assembly. General Joseph E. Johnston of the Confederate Army was born at Longwood, near Farmville. In 1865 just before the surrender at nearby Appomattox, there was fighting in this county and the last major engagement between Lee's and Grant's armies occurred at Sayler's Creek.

SOIL, WATER, AND PLANT MANAGEMENT STATUS

Beef and dairy operations, flue cured, dark fired and burley tobacco have been the principal agricultural enterprises in the county for the last 50 years. None of the flood plain land can be managed to produce to its full potential because of the flood hazard. About half of the flood plain is inundated one or more times a year. These lands are potentially the most productive when not subject to flooding, and have the least erosion hazard of any area in the watershed. Even with the present flood hazard, almost 18 percent of the flood plain is used for pasture, with another 13 percent used for cropland to provide the on-farm feed and forage needs of 77 operators who own flood plain land. About 50 percent of the flood

plain has been abandoned for use as cropland or pasture because of the flood hazard.

Urban type development is encroaching on agricultural land in the watershed. Presently, this pressure is most pronounced in the Farmville and Worsham areas, but seen also in other parts of the watershed. This trend is expected to continue. Future land use will show a gradual shift of the marginal cropland into pasture or nonagricultural uses. The remaining, more productive, cropland will be more intensively farmed to meet the demand for tobacco, corn, wheat, soybeans, and other food crops.

The Piedmont Soil and Water Conservation District provides conservation planning and application assistance to landowners and operators in Prince Edward County. It also reviews developers' site plans. The district actively promotes conservation land treatment.

Land cover conditions are fair, with small scattered areas on many farms in need of special conservation practices. Sixty-one percent of the 445 farms have cooperative agreement with the Piedmont Soil and Water Conservation District. All cooperators have installed conservation practices. Two hundred nine operators have developed conservation plans for their entire units, and 62 are in the process of developing complete plans. Approximately 65 percent of the practices planned have been installed. The conservation practices applied include pasture and hayland management, pasture and hayland planting, stripcropping, minimum tillage, crop residue management, ponds for livestock water, tree planting, and other conservation practices. See Appendix D for a description of these measures. Adequate treatment has been applied to 2,311 acres of cropland, 3,714 acres of pastureland, and 31,800 acres of forest land.

PROJECTS OF OTHER AGENCIES

Lake Chesdin is located on the Appomattox River downstream from its confluence with Bush River. This facility supplies municipal and industrial water to the cities of Petersburg and Colonial Heights, the counties of Dinwiddie and Prince George, and the southeastern part of Chesterfield County. The only relationship between Lake Chesdin and the proposed project is the reduction in sediment entering the reservoir as a result of the Bush River project.

Prince Edward County plans to install a water supply and distribution system in conjunction with the Bush River Watershed Project. Water from the reservoir will also be used to supply the town of Farmville and nearby Cumberland County.

A water treatment plant, with an initial capacity of 1.00 mgd, will be constructed adjacent to the reservoir on Sandy River. The plant will be designed for easy expansion to 2.00 mgd in order to meet the demands of any major water using industry. The proposed plant would consist of an aerator, a flash mix basin, flocculation and sedimentation facilities, rapid sand filters, and chlorination facilities. The plant building will house the filter gallery and controls, laboratory, workshop, and storage space for chemicals.

The proposed water distribution system, which will provide adequate fire protection in addition to municipal and industrial needs, will include an 18-inch main from the reservoir and treatment plant to the town of Farmville. A 12-inch main will continue around the south side of Farmville along the proposed U.S. Highway 460 by-pass to its junction with old U.S. Highway 460 west of the town. An 8-inch main will be constructed from that point to Prospect and Pamplin City. Another 8-inch main will run from the south side of Farmville to Hampden-Sydney College. A third 8-inch main will extend to the community of Rice. All other mains in the system will be 6-inch and 4-inch. Storage tanks will be provided south of the town, at the intersection of the proposed U.S. Highway 460 by-pass with old U.S. Highway 460 west of town, and near Elam. Booster pumps will be provided to increase pressure on the line to Hampden-Sydney, and on the line to Prospect and Pamplin City. The spacing of fire hydrants will be based on recommendations of the National Board of Fire Underwriters.

Prince Edward County, having adopted acceptable land use and control measures to regulate development in flood-prone areas, is included in the Federal Insurance Administration's list of areas (communities) eligible to participate in the National Flood Insurance Program. The Department of Housing and Urban Development has not published an FIA Flood Hazard Boundary Map for the county; however, most of this information will be available in the Bush River Watershed area as a result of the watershed project. The county is included in the "emergency program" at this time, since a detailed flood insurance study is necessary to qualify for the "regular program."

There are no other existing or proposed projects of other agencies, within or outside the watershed, which would be affected by the proposed works of improvement included in the watershed plan.

WATER AND RELATED LAND RESOURCE PROBLEMS

LAND AND WATER MANAGEMENT

Until the late 1930's, gully and sheet erosion resulting from overgrazing of pastures, lack of conservation measures on cropland, and poor harvesting practices on forest land, were major problems in this watershed. Up to 75 tons of soil per acre were lost each year from the steep areas, with lesser amounts lost on the moderate slopes. In recent years this situation has been greatly improved through conservation land use planning and the increased installation of conservation practices, by landowners and operators. There is still need for additional land treatment measures throughout the watershed in order to utilize the land to its best potential. These needed adjustments appear to be within the financial capability of the landowners, with the assistance available through current conservation programs. Practices needed are contained in Appendix D. A continuing effort is being made to encourage more widespread application of conservation practices by landowners and operators. Providing technical assistance to landowners to establish needed land treatment will be a major factor in the installation of an overall watershed management program.

FLOODWATER DAMAGE

Runoff from storms of the 5-year frequency block road approaches to five bridges and inundates about 83 percent of the flood plain area. The 100-year frequency storm runoff blocks 12 roads. Flows from large storms also carry debris, sediment and other contaminants which cause various problems. Weed seeds are deposited on pasture and cropland fields, increasing farm operating costs. Also, health hazards often arise when deposits from flood flows are left on flood plain areas and road crossings. Flood-blocked roads cause economic losses to residents either from long detours to market or loss of income because places of employment cannot be reached.

The most damaging storm in recent years occurred in June 1972. It produced stages at some locations with an estimated recurrence interval of approximately 80 years, and caused approximately \$182,000 in direct physical damage to flood plain improvements and agricultural interests. Other serious floods occurred in August 1940, September 1944, and September 1945. Their frequencies are estimated at 25-year, 10-year, and 10-year respectively. The damages assigned to these storms are \$96,000, \$61,650, and \$61,650 respectively. The most damaging floods often occur following high-intensity, short-duration, rainfall from storms of tropical origin. These storms give little warning of their approach and move through the area quickly causing rapid development of flood flows.

As late as the 1940's about 2,850 acres of the flood plain was used for cultivated crops and pasture. Beginning in the late 1940's, due to the flood hazard, about 2,200 acres have been abandoned and are now idle or brushy woodland; providing very little of economic value to the landowners. This has not only decreased farm operating efficiency, but also aggravated the erosion and sedimentation problems in the watershed and downstream channels. In addition to being more erodible, about two acres of upland are needed to replace the production of one acre of flood plain.

The 100-year frequency storm runoff inundates 3,812 acres below proposed structure sites on Bush River and its tributaries, with over 83 percent of the area inundated by the 5-year frequency storm runoff and over 76 percent by the 2-year runoff. At the present time, none of the agricultural flood plain can be managed to produce to its potential. As more of the upland in the county is developed for nonagricultural use, the flood plain areas will become important for the production of food and fiber. Average annual damages to crops and pasture are estimated to be \$3,700.

Existing agricultural improvements such as fences, private roads, ponds, etc. in the flood plain vary in their susceptibility to damages. The average annual damages to these improvements amount to \$54,070.

There are 3.5 miles of public roads and 15 bridges in the area affected by this project. Some of these roads are blocked annually by flood-water for one to three hours. The runoff from the 100-year frequency storm blocks 12 of the roads from two to 24 hours, causing serious traffic problems, especially on the major U.S. Highways, and loss of income to the residents. Average annual damages to these improvements amount to \$10,410, exclusive of loss of income, cost of re-routing, and traffic delays.

Other improvements subject to damage include barns, commercial properties, an airstrip and mobile homes. Damages to these improvements are estimated at \$3,265 annually.



Fig. 8 Floodplain damage—October 1972



Fig. 9 Floodplain damage—June and October 1972



Figure 1. [Illegible text]



Figure 2. [Illegible text]

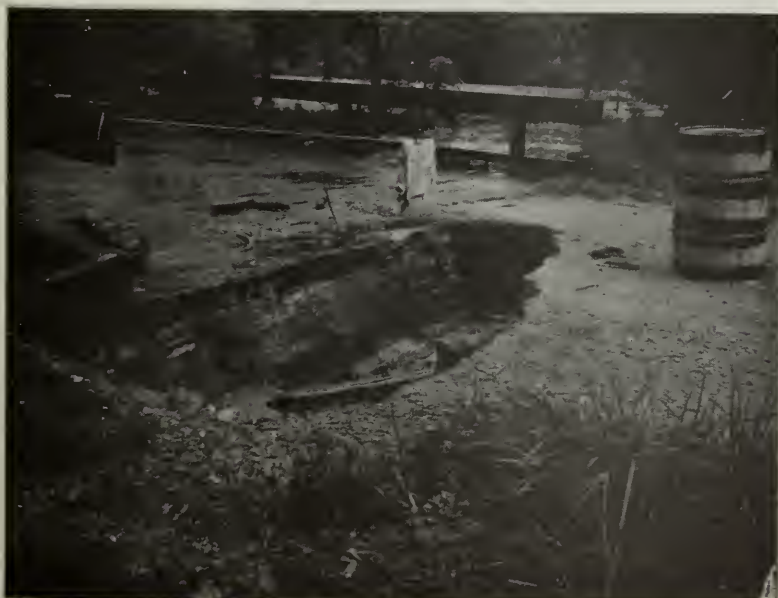


Virginia Highway 665
Briery Creek Flooding
July 1975

Fig. 10

Virginia Highway 637
Bush River Flooding
Bridge and Road
July 1975

Fig. 11



Virginia Highway 632
Damage to Bridge
From Flooding of
Bush River — July 1975

Fig. 12

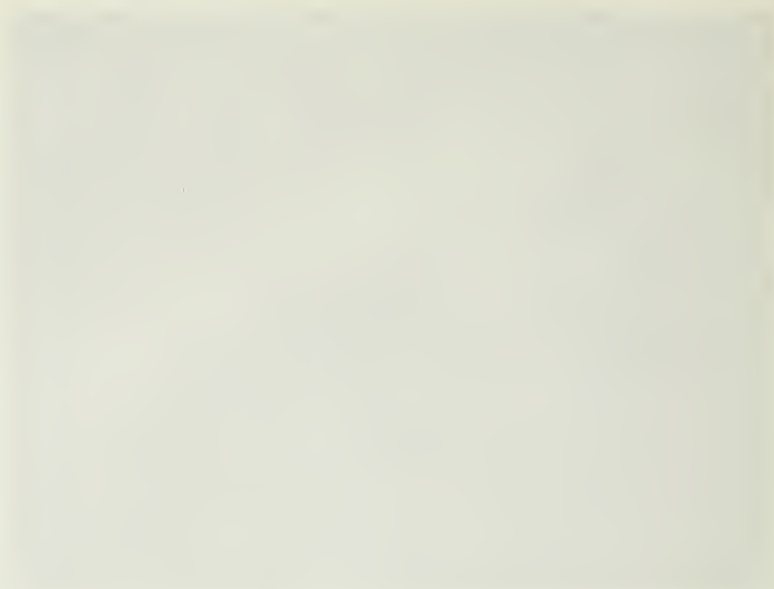
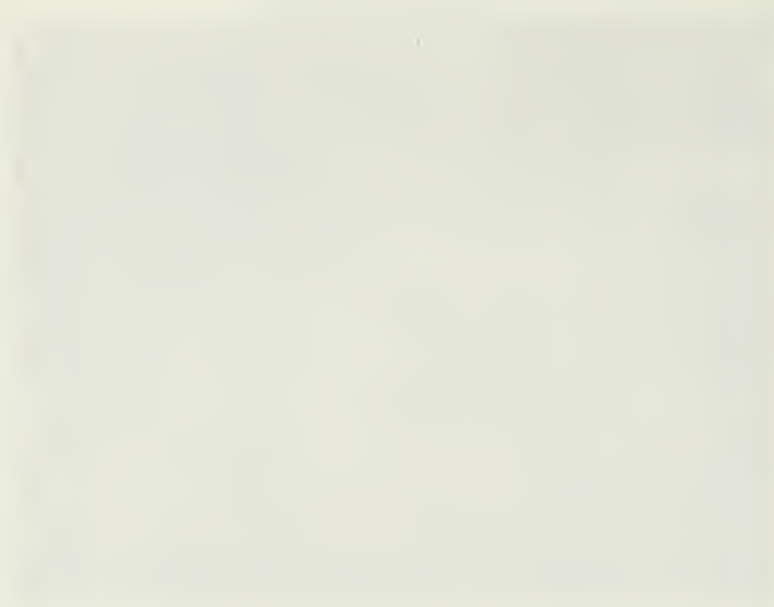




Fig. 13 Virginia Highway 628—Bush River Flooding
July 1975



Fig. 14 Virginia Highway 623— Bush River Flooding
Bridge - July 1975



EROSION DAMAGE

Because of farming practices, crops grown and soil types, erosion of the upland has been a very serious problem. In recent years land use changes made and conservation measures applied have reduced the problem considerably. Several factors, when considered together, make upland erosion a continuing source of damaging sediment. Among these are untreated road cuts and fills, sheet erosion on cropland, overgrazing of pastures, poor overall hydrological conditions of forest land, and poor logging practices in harvesting forest products. Sheet erosion on cropland, as computed by accepted Soil Conservation Service criteria, is about 47 tons per acre per year, and estimated values for other uses show an average on all land of 5.8 tons per acre per year. The cropland producing the greatest amount of sediment in the watershed is the 1,779 acres in land capability class III, the 1,331 acres of class IV, the 56 acres in class V, 397 acres in class VI, and the 693 acres in class VII. Erosion rates from untreated road cuts and fills can exceed 100 tons per acre per year.

A survey of the agricultural bottom land shows that the productive capacity of 2.5 acres has been reduced 40 percent by scour. These damages amount to an estimated \$100 annually.

SEDIMENT DAMAGE

Frequent flooding leaves deposits of fine-grained sediment over rather large areas, and coarser materials at localized areas of the flood plain. These coarse, infertile deposits damage the land and result in loss of production and income to the landowners. The finer sediment deposited over large areas causes a lesser amount of damage to productivity. Sediment deposition has reduced the productive capacity of 303 acres of flood plain land. This has resulted in a 10 percent loss of income on 231 acres and 20 percent on approximately 72 acres, causing losses to landowners estimated at \$2,700 annually. In addition floodwater often deposits fine sediment on crops at various stages of maturity, causing serious quality damage.

Sediment deposition from flood flows on roads and bridges causes added clean-up and maintenance costs and creates a safety hazard to motorists. Difficulties in vehicle control occasionally result in serious accidents. Deposits of sediment from floods reduce bridge and channel capacities, and lower storage capacity of reservoirs. Such deposits also lower water quality for municipal and industrial uses, recreation, fish habitat, fishery potential, recreational boating, esthetic values, or other possible future uses.

Sediment originating in the watershed moves into the Appomattox River and eventually the James River estuary and the port of Hampton Roads. Lake Chesdin, operated by the Appomattox Water Authority, is located on the Appomattox River downstream from Bush River. Municipal and industrial water is supplied from this reservoir to the cities of Petersburg and Colonial Heights, and to large areas of Dinwiddie, Prince George, and Chesterfield Counties. Sediment delivered from Bush River to the Appomattox River was determined to be 57,564 tons per year and to Lake Chesdin 28,782 tons per year (35,402 cubic yards). The trap efficiency of Lake Chesdin is estimated to be 70 percent. Under present conditions, approximately 8,635 tons (10,621 cubic yards) of sediment per year from Bush River reaches the James River. These downstream damages to Lake Chesdin and the navigable channels of the Appomattox and James Rivers are estimated to be \$197,240 annually based on current sediment removal costs.

Removal and disposal of sediment from Lake Chesdin is becoming progressively more difficult each year. Recent sediment control regulations have required development of expensive measures to control and dispose of even small amounts of sediment which accumulates in filters during the treatment processes. Removal and disposal of this sediment is becoming progressively more expensive. Removal of sediment from the navigable channels of the James and Appomattox Rivers has been an expensive measure for over 50 years. Recent environmental concerns and requirements concerning removal of this sediment have caused increased dredging cost and have complicated the disposal methods and operations. Recreational fishing has also been found to be adversely affected by sediment load in flowing streams, however, no attempt was made to evaluate these damages.

Dr. C. H. Wadleigh 1/ states:

"...Sediments constitute the main burden of pollutants in our surface waters."

"Committee Print No. 9 of the Senate Select Committee on Water Resources states that 'Rough estimate of the suspended solids loadings reaching the Nation's streams from surface runoff shows these to be at least 700 times the loadings caused by sewage discharge.'"

"...Carl Brown 2/ 'estimated that only about 1 ton in 4 of the silt produced by erosion from our watersheds ever reaches the ocean'..."

1/ Wadleigh, C. H., 1968, Land Run-Off in Relation to Water Contamination. Presented at the Annual Meeting of Virginia Soil Conservation Districts, Richmond, Virginia, January 9, 1968.

2/ Carl Brown. Proceedings, The National Conference on Water Pollution, December 12-14, 1960, Washington, D.C.

"Aside from filling stream channels and reservoirs, suspended sediment makes necessary expensive additional treatment processes for municipal and industrial water supplies. Sediment impairs oxidation of organic pollutants in streams. They cause erosion of power turbines, pumping equipment, and other structures. They reduce fish and shell fish population by blanketing the nest, spawn, and food supplies..."

Studies by the Federal Water Pollution Control Administration now the Environmental Protection Agency and United States Fish and Wildlife Service show that the success of our sport and commercial fisheries industry, is largely dependent on the water quality and food production in estuaries and rivers. Many commercially and recreationally important fishes require estuarine nurture for survival to maturity. For example, at some time in their life cycles, shad, striped bass, herring, perch, flounder, sea trout, spot, drum, snapper, and bluefish live in the estuaries. In addition, estuaries provide for production of clams, oysters, and crabs. The estuarial mud flats support several inter-tidal species of crustacea and provide winter food and resting areas for wild ducks and geese.

Sedimentation, including material moved along the streambed, is universally recognized as harmful to stream biota in many ways 1/. It affects light penetration of water, inhibits growth of stream bottom organism used as food, affects oxygenation of waters, covers spawning and nesting areas, covers fish and other eggs, adversely affects fish gills, and causes other damages or reactions which affect the welfare of associated flora and fauna. It is difficult to assign monetary values to all the above damaging effects. No estimates could be obtained for these damages in the James River or its tributaries; consequently, an economic evaluation of these damages could not be made.

MUNICIPAL AND INDUSTRIAL WATER PROBLEMS

At the present time, a public water supply system owned and operated by Farmville furnishes water to the town and adjacent areas of Prince Edward County. This municipally owned system uses surface water from Buffalo Creek. The water is coagulated, settled, filtered, and chlorinated in a plant having a capacity of 1.1 mgd, with present consumption ranging from 0.6 to 0.75 mgd. Storage facilities consist of three covered steel standpipes with a combined capacity of 1.7 million gallons, and a 0.1 million gallon clear-well used for storing finished water at the treatment plant.

1/ Hollis, E. C., J. G. Boone, C. R. DeRose, G. J. Murphy, 1964. A Literature Review of the Effect of Turbidity and Siltation on Aquatic Life. Staff Report Department of Chesapeake Bay Affairs, Annapolis, Maryland.

Hampden-Sydney College, located about five miles southwest of Farmville in Prince Edward County, operates its own water supply system. The water for this system is obtained from four drilled wells. The water from one well is aerated, settled, and filtered for iron removal in a plant having a capacity of 108,000 gallons per day. The only other public water supply systems in the county are located at Prince Edward State Park and Goodwin Lake State Park. Water for these systems, which are owned and operated by the State of Virginia, is obtained from wells.

Privately owned wells are the primary source of domestic water in the rural areas of the county. Small industrial users in these areas also depend on wells. The most productive wells in the county range from 300 to 350 feet deep and generally yield from 50 to 75 gallons per minute. Several other wells that are more than 500 feet deep yield less than 50 gallons per minute. The yield of wells in the Prospect, Rice, Dowdy Corner and Sandy River Church areas has been running less than 5 gpm. Several dry holes are drilled each year, and a number of others are abandoned because of inadequate yields. A review of well records over the past 25 years indicates that, while the number of wells drilled is increasing each decade, the depth necessary to maintain the same yield is increasing. The average yield of existing wells has decreased during this time. The quality of well water in Prince Edward County does not usually permit direct use without some type of treatment. There are many areas that have excessive iron or hardness, and others where sulfates and magnesium are a problem. Therefore, it seems highly probable that the use of wells as a source of public water supply for the county must be predicated on the use of a large number of wells, and also on the assumption that complete treatment facilities will be required.

Prince Edward County is located about equi-distant from the Richmond, Petersburg-Colonial Heights, and Lynchburg metropolitan areas. Three new industries, and several new businesses have located in the county within the past 10 years. Others have located elsewhere due to the lack of an adequate water supply. The growth of service facilities in the area is another indication of the rapid development that is taking place in Prince Edward County. Orderly development of the county will require the addition of surface storage, a water treatment plant, and a water distribution system. Consulting engineers retained by the county have recommended development of the Sandy River site to include municipal and industrial storage, as a part of the overall Bush River Watershed project, in order to supply the anticipated needs of an integrated county-wide system.

The following table from the consultant's report shows the projected water requirements for Prince Edward County, including the town of Farmville, between 1975 and 2020.

PROJECTED WATER REQUIREMENTS
FOR PRINCE EDWARD COUNTY
(million gallons per day)

Year	Type of Use			Total Needs
	Domestic	Industrial	Agriculture	
1975	1.30	1.82	1.24	4.36
1980	1.50	2.13	1.30	4.93
1985	1.70	2.50	1.36	5.56
1990	1.80	2.77	1.42	5.99
1995	2.10	3.01	1.48	6.59
2000	2.40	3.07	1.54	7.01
2005	2.70	3.27	1.60	7.57
2010	3.00	3.37	1.66	8.03
2015	3.30	3.49	1.72	8.51
2020	3.70	3.58	1.78	9.06

Based on the consultant's report, water use by Farmville will vary from 1.13 mgd in 1975 to 2.13 mgd in 2020. Nearby Cumberland County has also requested the additional storage necessary to provide them with 2.00 mgd, which is their projected needs for the year 2020. Therefore, the total projected net demand is 11.06 mgd. A total of 10,000 acre-feet of municipal and industrial water supply will be required to meet this net demand.

RECREATION AND PLANT AND ANIMAL PROBLEMS

The present human population and the projected population by 1980 within one hour's driving time of the watershed is 578,000 and 694,000, respectively. There are two public recreation facilities located in the Bush River Watershed. Both of these facilities are a part of the State Park System, Prince Edward State Park and Goodwin Lake State Park. Both facilities are filled to capacity during the summer months on weekends and other heavy use days.

Generally, water quality is good for fishing and recreation except during high flows when it carries a high sediment load and during low rainfall period when most streams become just a trickle. Availability of fishing open to the public is along the larger tributaries, primarily where a public road crosses over one of the streams. Litter is a problem at these sites. Fishing is permitted on Goodwin Lake (15 acres) and Prince Edward Lake (32 acres) which are shared with swimmers, waders, and pleasure boaters.

There has been a change in wildlife habitat in recent years due to changing land use patterns. Many flood plain fields which were formerly planted to corn, small grain, and other seed crops have been abandoned because of flooding during the growing season. Consequently, the fall and winter food supply provided by waste

grain is no longer available. In some cases, open areas and edges have been replaced by dense growths of brambles, shrubs, and young trees. Flooding in recent years has torn out beaver dams, eroded stream banks, and filled stream beds with debris. Hunting is allowed, in season, in the adjacent Prince Edward-Gallion State Forest. Most private property is posted with hunting limited to family and friends. There are no known threatened or endangered plant or animal species within the watershed.

WATER QUALITY PROBLEMS

Water quality for human consumption is not a problem in this watershed. Sediment and animal waste are the principal threats to water quality but at this time are not a significant factor. Sediment arising in the watershed does, however, contribute to loadings downstream. Water quality data is displayed in Appendix G.

ECONOMIC AND SOCIAL PROBLEMS

The 1969 Census of Agriculture indicates that 60.5 percent of the farms in Prince Edward County had gross sales of less than \$2,500. Slightly over two-thirds of these farms were classified as part-time or part-retirement farms. Almost one-third of these farms (19 percent of all farms in the county) had less than \$2,500 gross sales, the operator was under 65 years of age and had less than 100 days off-farm employment during the census year. A review of the watershed information indicates about 55 percent of the farms had less than \$5,000 gross sales. Most of these farms are classified as part-time or part-retirement. There are 19 farms in the watershed which use 1-1/2 or more man-years hired labor.

The 1970 census 1/ indicated an average per capita income of \$2,225 and mean income per family of \$5,137 for Prince Edward County compared with an average for the state of \$3,012 and \$10,568 respectively. This indicates the average per capita income of approximately 74 percent of the state average, and family income of slightly over 48 percent of the state average. The census data also indicates that almost 28 percent of the families had less than \$4,000 annual income, compared to 16.2 percent of all families in the state. Approximately 70 percent of the homes had complete bathroom facilities and about 77 percent had complete kitchen plumbing facilities. The state average was 86.6 percent and 91.3 percent respectively.

1/ U.S. Bureau of the Census - 1970.

These facts indicate the seriousness of the need for development of all local resources to aid in more effective use of available labor resources to improve family income and living standards. Development of the land and water resources in the area will produce conditions which encourage economic growth, provide a public recreation facility in an area where existing facilities are badly overcrowded, and in general improve family life styles and living conditions.



RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

This plan has been developed in accordance with existing Federal, State and local land use plans, policies and controls. Particular attention has been given to the Federal Water Pollution Control Act Amendments of 1972. One of the major objectives of the plan is to reduce erosion on the watershed. The project will aid in reducing sedimentation in Lake Chesdin, operated by the Appomattox River Water Authority, and downstream in the navigable channels of the Appomattox and James Rivers and the port of Hampton Roads.

The Piedmont Planning District Commission, the local clearinghouse for Prince Edward County, is in the process of developing long-range area resource plans. Control of floodwater and sediment, an adequate municipal and industrial water supply, and improved facilities for recreational activities are major concerns in the region's resource and development plans. Surface storage in the Bush River watershed is a major component of the water supply plan now being developed for Prince Edward County and the Town of Farmville. The recreational facilities will serve a multi-county area, with over 863,000 people within a 70 mile radius of the lake sites. Other features of the watershed plan will serve as resource planning tools for the Planning District Commission, the county, and other agencies and groups for long-range planning, zoning and development of the area's resources.

The Commonwealth of Virginia under Section 873.5 of the Building Code has restrictions on the construction of buildings in the 100-year flood plain. These restrictions are compatible with the proposed project.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Approximately 19,810 acres of watershed land will be affected by the application of conservation land treatment and woodland management. Both vegetative and structural types of conservation land treatment will effectively reduce runoff, conserve soil moisture, and prevent excessive loss of topsoil on farms. Studies conducted by the Agricultural Research Service 1/ indicate reductions in runoff from 28 to 56 percent depending on the practices installed. The Extension Division of Virginia Polytechnic Institute and State University 2/ conducted studies that show no-tillage planting can result in 80 to 90 percent less runoff. See Appendix D for a description of individual land treatment measures.

Land treatment will help to restore and maintain soil productivity by adding or holding plant nutrients. It will reduce soil losses on cropland and pastureland so that a suitable soil profile will be available for future plant growth. Soil losses on woodland will be reduced to less than 1 ton per acre per year.

Degradation of surface waters by agricultural pollutants attached to soil particles will be reduced by reducing erosion and by using proper fertilization methods.

LAND USE IN THE BENEFITED AREA WITH AND WITHOUT THE PROPOSED PROJECT

Land Use	Acres in Use	
	Without Project	With Project
Corn-Grain	61	252
Barley	5	0
Silage	17	191
Hay	90	628
Pasture	610	945
Forest and Idle	2,994	1,630
Other	35	166

1/ Agricultural Research Service, Technical Bulletin 1281, USDA, Runoff and Erosion Control Studies on Cecil Soil in the Southern Piedmont.

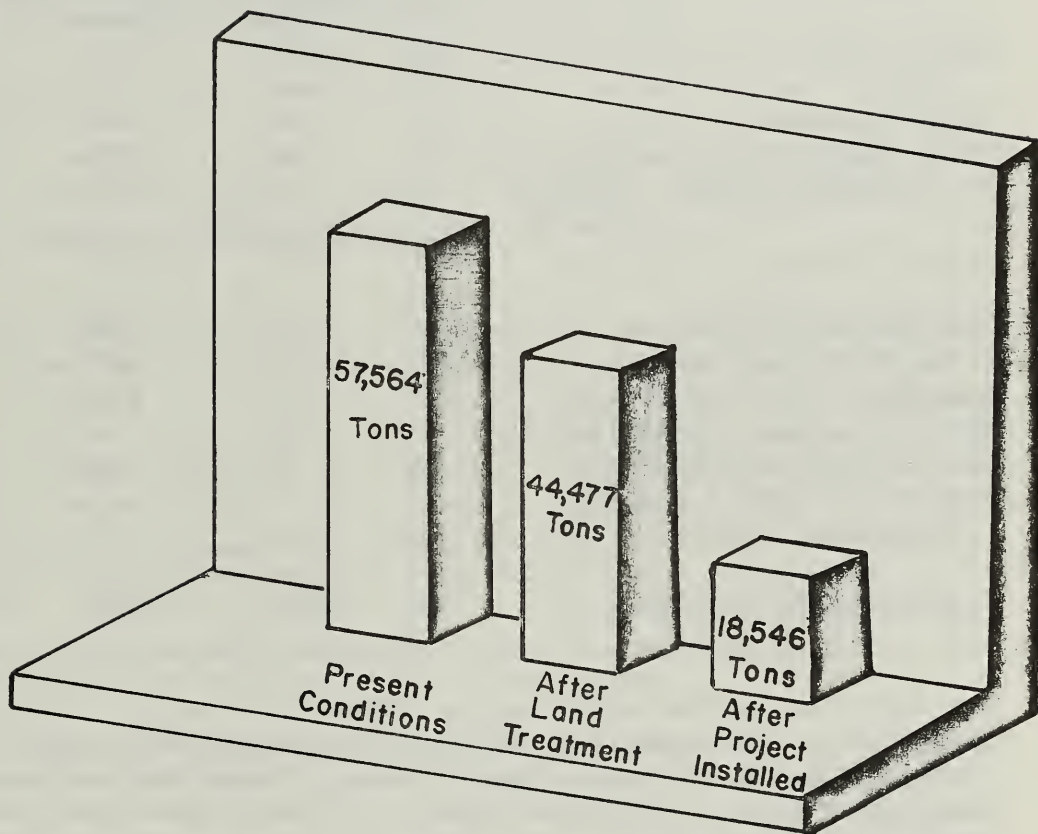
2/ Lillard, J. H., Professor and Tillage Research Leader and Smith, Easley S., Extension Specialist, Farm Machinery Department of Agricultural Engineering, VPI&SU, No-Tillage Machinery and Seedbed Requirements, Publication 419, Cooperative Extension Service, March 1971.

A resource management system is a group of interrelated conservation practices and management techniques applied to a given resource such as cropland, woodland, or pastureland for specified functions or uses such as: timber, forage, hay, or crop production; improvement of fish and wildlife habitat; improvement of water quality; and improvement of esthetics.

Many of the practices will enable landowners to more fully utilize sound resource management systems to increase efficiency of production. Planned land treatment is estimated to reduce the average gross from 5.8 to 4.5 tons per acre per year.

Conservation land treatment will reduce the amount of sediment leaving the watershed by about 13,087 tons annually. The sediment from Bush River contributes to the total load in the Appomattox and James Rivers. Therefore, reducing the production of sediment will lessen downstream damages to municipal and industrial water supplies, fish habitat, recreation, and esthetics. Inventories and evaluations and other requested technical assistance will provide basic information needed by landowners in planning land use changes and improved resource management systems.

All land uses (cropland, pasture, forest land, etc.) have value as wildlife habitat. Some of the vegetative practices that hold soil and water in place also add value to wildlife food and cover. The 19,810 acres of watershed land that will receive conservation land treatment measures and woodland management practices will have a greater overall beneficial effect on wildlife than the structural measures.



SEDIMENT FROM BUSH RIVER
REACHING THE APPOMATTOX RIVER ANNUALLY

STRUCTURAL MEASURES

Installation of the eight dams will require either a change or modification in land use on a total of 3,076 acres. Another 226 acres have been designated for fish and wildlife development, recreation facilities, and public access at sites 1E and 12. Only 71 acres will be required for these purposes when the project is installed, and the remaining 155 acres will be held for future expansion. An additional 10 acres will be required for water treatment facilities at site 12. The following table lists current land use for the affected acreage.

Project Use	Acreage Affected by Project			Totals
	Crop- land	Pasture- land	Forest land	
Sediment Pools	51	82	509	642
Water Supply Pool (additional)	94	56	370	520
Fish & Wildlife Pool (additional)	13	2	664	679
Total Permanent Pools	158	140	1,543	1,841
Dam and Spillway Areas	7	5	106	118
Flood Detention Pools	69	63	855	987
Emergency Spillway Storage	9	6	115	130
Water Treatment Facilities (12)	2	8	0	10
Recreation Facilities (12)	20	8	19	47
Fish and Wildlife Access and Recreation (1E)	24	0	155	179
Total Acreage Affected	289	230	2,793	3,312

The multiple-purpose water supply structure (No. 12), with 10,000 acre-feet of municipal and industrial storage, will supply the projected needs of Prince Edward County, Farmville, and nearby Cumberland County to the year 2020. The net demand rate to be supplied with this amount of storage is 11.06 mgd. This will allow for economic growth and orderly development of the county by providing adequate fire protection in addition to municipal and industrial water needs.

The area flooded by the 100-year frequency storm will be reduced by 655 acres, the 10-year frequency storm by 672 acres, the 5-year frequency storm by 779 acres, and the 2-year frequency storm by 1,152 acres. Maximum depth of inundation by the 5-year frequency storm will be reduced from almost 10 feet to about 4.5 feet, with only 20 percent of the area flooded over one foot deep. Maximum depth of inundation by the 2-year frequency storm will be reduced from 6 feet to 3 feet, with only 11 percent of the area inundated over one foot.

The eight structures will be designed to trap 3,718 acre-feet of sediment, which is the amount expected to accumulate over a 100-year period. The combined effect of the structures and land treatment measures in controlling sediment will reduce downstream damages from this source by 57 percent. The amount of sediment leaving the Bush River watershed will be reduced by 39,018 tons annually. A reduction of sediment deposits in downstream channels and reservoirs will not only improve the quality of municipal and industrial water supplies, but will also improve habitat conditions for fish and wildlife. Damages from streambank erosion, flood plain scour, and infertile overwash will be reduced by 56 percent as a result of the project. Sediment reaching Lake Chesdin, the municipal and industrial water supply reservoir operated by the Appomattox Water Authority, will be reduced by 19,509 tons annually. The amount reaching the navigable channels of the James River will be reduced by 5,854 tons annually. See figure on page II-66.

Sediment reduction will beneficially affect stream biota. Light will better penetrate the water, growth of stream bottom organisms will improve as will oxygenation. There will be less sediment to cover fish and other eggs and damage fish gills. Other sediment damages to aquatic flora and fauna will be reduced.

The 26.9 acre-feet of expected sediment production during construction of the eight structures will be reduced to 10.8 acre-feet by onsite erosion control measures. Sediment concentrations at the sites are expected to increase temporarily at times during construction, and then to drop sharply after installation of the structures and land treatment measures is completed. Appropriate measures will also be taken during construction to minimize water, air, and noise pollution. The plans and specifications for each structure will include erosion and sediment control measures. Measures to control water and air pollution will be accomplished through proper management of construction activities, and by compliance with applicable health and safety laws and regulations.

A total of four secondary road crossings and two forest trails will be affected by the permanent pools. Four additional secondary road crossings and one additional forest trail will be affected by the flood pools. No primary highways will be affected by installation of the structural measures. Prince Edward County will take the necessary action to either raise the roads which will be flooded by the permanent pools or close them where this is not economically feasible. Permission will be obtained from the Department of Highways and Transportation to close those roads within the flood pool temporarily during flooding. Authority for closing is granted in the Code of Virginia, Section 33.1-223.2. There would be only a slight increase in travel time due to such closings, since a good system of highways exists parallel to either side of the reservoirs.

During project installation, an estimated 120 man-years of employment will be filled from the local labor market. It is estimated that 30 full-time and 10 part-time workers will be required in the operation and maintenance of the eight structures and associated features. Most of these jobs will be a result of the fish and wildlife development, and related support facilities at site 1E; and the water supply and distribution system, and facilities for incidental recreation at site 12.

Completion of the project will provide for more efficient management by farm operators and other landowners on about 2,000 acres of the 3,812 acres of protected flood plain. A total of 77 present landowners will directly benefit from flood prevention as a result of the project. This will result in the conversion of an estimated 1,230 acres of forest and idle land to crop and pasture and other uses. Presently, this land is covered with brush or young trees and was recently in cropland. This conversion in the protected flood plain will reduce cover and increase food supplies for forest wildlife.

The planned fish and wildlife development at site 1E will result in 814 acres of warm-water fish habitat and associated fish and wildlife facilities. The lake will create 14.5 miles of new shoreline, while inundating 8.7 miles of perennial streams and 1.5 miles of intermittent streams. The municipal and industrial water supply lake (site 12) will have a similar fishery with a minimum of 220 acres and a maximum of 740 acres. Up to 520 acres will be exposed from drawdown for water supply during prolonged drought. This lake will create 17.7 miles of new shoreline, while inundating 6.1 miles of perennial streams and 2.5 miles of intermittent streams. The six single-purpose floodwater retarding structures will create 287 surface acres of semi-permanent water in the area reserved for sediment; these structures will also create 13.4 miles of new shoreline, while inundating 5.9 miles of perennial streams and 2.0 miles of intermittent streams. The affected streams contain low populations of fish and are subject to very little fishing pressure. Recreational opportunities for lake fishing at the two sites are expected to result in 159,100 fisherman days annually. The additional activity at these sites will result in an increase in: vehicular traffic, noise, fire hazard, solid waste, and litter.

An estimated winter breeding population of 30 deer, 4 wild turkeys, 350 gray squirrels, and an unknown number of cottontail rabbits, and other small animals will be displaced from the 1,841 acres that will become pool areas. Some species such as eels, dace, fallfish, and various darters and shiners will decrease in the reservoirs while other species such as largemouth bass, pickerel, sunfish, and catfish will increase in population (see page II-71 for a complete list). Inundation of the flood detention pool areas will temporarily displace terrestrial species, but at the same time protect these

same species in the flood plain below the structures. Wildlife habitat in the flood pool areas will be protected from future development either by public ownership or flowage easements. There will be a total of 60 acres of Type 1 wetland ^{1/} inundated by the permanent pools, including: 38 acres on Briery Creek, 18 acres on Sandy River, and 2 acres each on Cunninghams and Mountain Creeks. This type of habitat (intermittently flooded wooded bottom lands) which is used by woodcock, beaver, muskrat, and wood ducks, would be lost. The migratory waterfowl in the spring and fall would not be adversely affected. Similar new shallow water marsh areas will develop in the flood pools near the upper end of the permanent pools, especially on site 1E, (Briery Creek). The Virginia Commission of Game and Inland Fisheries has purchased 2,000 acres around the proposed Briery Creek Reservoir, and this area will be managed for wildlife. The project impact on the other riparian wildlife species such as muskrat, raccoon, river otter, and mink are hard to determine. Animals such as frogs, salamanders, water snakes, turtles, and birds such as the osprey, kingfisher, loons, grebes, and great blue herons will be benefited.

Construction of the eight dams will require the clearing or inundation of 1,543 acres of forest and other land in the permanent pool areas, and the clearing of another 43 acres one foot above the riser of the permanent pool level. An additional 200 acres in the construction areas will be cleared and grubbed. This forest land consists of stands of cut-over hardwood and brush. The hardwoods provide habitat for many animals including squirrels and songbirds, and the cut-over areas provide some habitat for deer, rabbits, quail, and other small nongame animals. The 987 acres in the flood detention pools, which are about 87 percent wooded, will only be flooded occasionally. While wildlife habitat patterns will be temporarily disrupted during flooding, flowage easements will protect these areas from future development. There are no known threatened plant or animal species within the watershed.

Additional storage is available in structures 1E and 12 to provide a minimum downstream release equal to the 10-year, 7-day low flow at each of these sites. The openings are sized to release amounts up to normal flow. A continuous supply of water below these two dams will prevent detrimental effects to the plant communities and the stream ecosystem. Similar openings in the other six dams will serve the purpose of maintaining the down stream flow at least equal to the flow immediately above the impoundment, when that flow is equal to or less than the average flow, as required by Virginia state law.

^{1/} Shaw, S.P., and Fredine, C.G., 1956. Wetlands of the United States. United States Department of the Interior, Fish and Wildlife Service Circular 39.

FISH SPECIES KNOWN IN BUSH RIVER PROJECT AREA
AND EXPECTED POPULATION CHANGES IN THE IMPOUNDMENT AREAS

<u>Common Name</u>	<u>Scientific Name</u>	<u>Expected Impact</u>
American eel	<i>Anguilla rostrata</i>	E
Chain pickerel	<i>Esox niger</i>	S+
Stoneroller	<i>Campostoma anomalum</i>	E
Carp	<i>Cyprinus carpio</i>	S+
Silvery minnow	<i>Hybognathus nuchalis</i>	S
Bluehead chub	<i>Nocomis leptcephalus</i>	E
Golden shiner	<i>Notemigonus crysoleucas</i>	S+
Comely shiner	<i>Notropis amoenus</i>	E
Satinfin shiner	<i>N. analostanus</i>	E
Rosefin shiner	<i>N. ardens</i>	E
Bridle shiner	<i>N. bifrenatus</i>	E
Common shiner	<i>N. Cornutus</i>	S
Swallowtail shiner	<i>N. procne</i>	E
Blacknose dace	<i>Rhinichthys atratulus</i>	E
Creek chub	<i>Semotilus atromaculatus</i>	E
Fallfish	<i>S. corporalis</i>	S or E
White sucker	<i>Catostomus commersoni</i>	S or S+
Creek chubsucker	<i>Erimyzon oblongus</i>	S
Northern hog sucker	<i>Hypentelium nigricans</i>	S or E
Yellow bullhead	<i>Ictalurus natalis</i>	S+
Brown bullhead	<i>I. nebulosus</i>	S+
Margined madtom	<i>Noturus insignis</i>	E
Pirate perch	<i>Aphredoderus sayanus</i>	S or E
Eastern mudminnow	<i>Umbra pygmaea</i>	S+
Mosquitofish	<i>Gambusia affinis</i>	S or S+
Flier	<i>Centrarchus macropterus</i>	S
Redbreast sunfish	<i>Lepomis auritus</i>	S or S+
Pumpkinseed	<i>L. gibbosus</i>	S or S+
Warmouth	<i>L. gulosus</i>	S+
Bluegill	<i>L. macrochirus</i>	S+
Smallmouth bass	<i>Micropterus dolomieu</i>	S or E
Largemouth bass	<i>M. salmoides</i>	S+
Black crappie	<i>Pomoxis nigromaculatus</i>	S+
Fantail darter	<i>Etheostoma flabellare</i>	E
Johnny darter	<i>E. nigrum</i>	E
Glassy darter	<i>E. vitreum</i>	E
Stripeback darter	<i>Percina notogramma</i>	E

S = Survival: S+ = Possible Expansion

E = Extirpation or severe reduction within impoundment

ECONOMIC AND SOCIAL

The comprehensive land and water resources plan proposed for Bush River watershed will provide conditions which allow more effective land use, improve scenic values, enhance the local economy, and aid in improving local living standards.

The primary objectives of this project will be realized by: implementing a land treatment program which will effectively control erosion and resulting sedimentation from uplands; providing a minimum of 2-year frequency protection to 50 percent of the flood plain inundated by the 100-year frequency storm; protecting existing highways and other improvements in the watershed from significant damage by the 100-year frequency event; development of municipal and industrial water supply storage; and development of a major fish and wildlife lake.

Land use changes and other adjustments consistent with overall development plans will allow a higher level of management on 2,430 acres of agricultural land and 130 acres of other land. Use of such practices as improved crop varieties, more timely planting, cultivating, and harvesting of crops; increasing production of forage and grain crops; and producing crops for food will improve both farm income potential and the quantity and quality of food available to meet local and regional needs. Increased agricultural production and other economic activities associated with the recreation development and municipal and industrial water systems will improve both farm and off-farm employment opportunities for an undetermined number of presently unemployed, or underemployed workers.

A committee familiar with local conditions determined that installation of this project will aid in maintaining a sound local tax base by protecting flood plain improvements, providing facilities and technical information necessary for the planned developments, land use changes, and use of the area's resources. The committee was made up of the County Extension Agent, District Conservationist, prominent farmers and farmer-businessmen. Interviews with farmers and other landowners who own or operate land in the flood plain state a need for more intensive and changed land use. The committee based its conclusions on personal experience, scientific data, and observation of existing projects in the region.

Traffic interruptions from flood-blocked roads will be virtually eliminated for the 3,550 people now living in the watershed, the 2,000 to 3,000 new residents expected within the next 20 years, and the many thousands of travelers who use highways daily.

Homes with complete kitchen facilities are expected to increase from 77 percent in 1970 to 95 percent; and those with flush toilets will increase from 70 percent in 1970 to about 90 percent in the next 20 years. The state average for these items in 1970 was 88.6 and 91.3 respectively. The above percentages, when applied to the 1970 and 2020 population figures respectively, show about a 100 percent increase in water users.

As a result of opportunities for improved land use and management and off farm employment resulting from the project, average family income is expected to increase by approximately \$1,500 annually by 1985. This would increase per-family income from the present 48

percent to about 64 percent of the average family income in the state.

Development of the fish and wildlife, recreational and water supply features will provide opportunities for an increase in local commercial and industrial operations. This will increase employment opportunities and income levels for an undetermined number of residents who are presently underemployed, or unemployed, resulting in improvements to regional and national production and income.

Installation of the project will provide an estimated 120 man-years of employment. After project completion it is anticipated that 30 full-time and 10 part-time semi-skilled jobs will be created in connection with the utilization, operation and maintenance of project features. Most of these jobs will be associated with structures 1E and 12 in connection with the fish and wildlife and recreation development and municipal and industrial water supply. Operation and maintenance of the single-purpose floodwater retarding structure will provide the remainder of the jobs.

Benefits from this project will extend beyond the limits of the project area. This project will aid in reducing damages on the Appomattox River downstream from the confluence with Bush River. In addition to the reduction of floodwater damages, sedimentation will be reduced in the navigable channels of the Appomattox River, the James River estuary, and the port of Hampton Roads. However, no monetary evaluation of these benefits was attempted.

INTERNATIONAL IMPACTS

There are two accredited liberal arts colleges in Prince Edward County, both of which enroll students of other nations. Longwood College at Farmville is the successor to a series of institutions at this location which began in 1835. It was the first teacher-training college in Virginia and has been state supported since 1884. Graduate degrees in education are offered, as well as bachelor degrees in the arts and sciences. Part of the campus of Hampden-Sydney College is located in the northwest portion of the Bush River watershed about seven miles southwest of Farmville. This college has operated since 1776, and is one of the oldest colleges for men in the nation. It has over 600 students and offers B.S. and B.A. degrees. Faculty members and alumni of this college have played important roles in our nation's affairs for nearly two centuries.

Installation of the planned project measures will serve as an example to the students of these colleges and their visitors from other nations of the application of modern planning techniques and environmental considerations in the orderly development of land and water resources for area development and improvement.

FAVORABLE ENVIRONMENTAL EFFECTS

- a. Reduce floodwater and sediment damages by approximately 62 percent
- b. Reduce sediment leaving the watershed by 39,018 tons annually
- c. Reduce erosion, retard runoff, improve wildlife habitat, and enhance the esthetic values of the watershed by accelerating installation of land treatment measures on 19,810 acres
- d. Provide 814 acres of warm water fish habitat for a planned fish and wildlife development with 14.5 miles of shoreline, 179 acres for facilities to provide 122,000 visits annually at site 1E
- e. Provide a maximum of 740 acres of warm water fish habitat, with 17.7 miles of shore line and 47 acres of incidental recreation facilities to provide for 37,100 recreation visits annually at site 12
- f. Create approximately 120 man-years of employment during construction, 30 permanent full time jobs, and 10 permanent part time jobs after project installation is complete
- g. Provide 10,000 acre-feet of high quality water storage which is equal to approximately 3.3 billion gallons which will supply the local needs until the year 2020
- h. Increase farm income by allowing more efficient and effective use of about 2,430 acres of agricultural flood plain.
- i. Reduce downstream sediment damages to the Appomattox River, Lake Chesdin, and the James River
- j. Improve the economic, safety, and health conditions in the watershed by controlling floodwaters
- k. Provide additional storage in the two multiple-purpose structures, with openings for downstream releases.
- l. Aid in maintaining a sound local tax base by protecting flood plain improvements, providing facilities and technical information necessary for the planned developments, land use changes and use of the area's resources
- m. Protect wildlife habitat in the flood pools from future development

- n. Protect terrestrial species in the flood plain below the structures
- o. Create a total of 1,554 acres of water and 45.6 miles of shoreline resting areas for local and migrating waterfowl and wildlife

ADVERSE ENVIRONMENTAL EFFECTS

- a. Inundate about 20.7 miles (14.7 percent) of the perennial streams and 6.0 miles (2.9 percent) of intermittent streams in the watershed
- b. Inundate or restrict use of 3,076 acres of land presently in forest land, cropland, and pastureland
- c. Increase turbidity at times during construction period
- d. Increase vehicular traffic, noise, fire hazard, solid waste and litter in and near the planned recreation areas
- e. Reduce terrestrial wildlife habitat by the 1,841 acres (7.7 percent) in the permanent pools
- f. Expose up to 520 acres drawdown for water supply during prolonged drought at site 12
- g. Inundate approximately 60 acres of Type 1 wetland 1/
- h. Four secondary road crossings and two forest trails will be affected by the permanent pools, and four additional secondary road crossings and one additional forest trail will be affected by the flood pools
- i. Convert 1,230 acres of forest wildlife habitat in the protected flood plain to cropland and pasture, and other uses.

1/ Shaw, S. P., and Fredine, C. G., 1956. Wetlands of the United States, United States Department of the Interior, Fish and Wildlife Service, Circular 39.

ALTERNATIVES

ACCELERATED CONSERVATION LAND TREATMENT ONLY

Under this alternative technical assistance would be provided to keep conservation plans up-to-date, to develop new plans as land ownership or land use changes, to maintain existing adequate cover, and to maintain installed practices. It would involve applying the needed conservation practices identified and described in the Land Treatment Measures under Planned Project. The total cost of this alternative would be \$973,900 including the cost of maintaining the going conservation program, during the installation period.

The effectiveness of this alternative in reducing soil erosion and sedimentation should be essentially the same as for land treatment in the proposed project; i.e. a 22 percent reduction at the end of the project installation period. Improved water infiltration into the soil due to conservation land treatment would not have a noticeable effect on a storm with a magnitude equal to or greater than a 10-year frequency. Floodwater damage reduction is estimated to be 6.7 percent.

This alternative would essentially meet the sponsors' objectives related to land treatment, but flood damages would continue to occur to agricultural interests, businesses, roads, bridges, and other flood plain improvements. The water supply objectives of the sponsors would not be met. There would be a net increase in cultivated crops on upland areas with this alternative. Growth and economic development of the area could not be accomplished at the rate desired by the sponsors due to inadequate water supply.

Another effect of this alternative would be that recreation needs of the area would remain unsatisfied. The facilities for an estimated 159,100 recreation visits annually would not be provided.

The 1,959 acres of land involved in the structure and water area, as proposed in the selected plan, would remain as cropland, pastureland, and woodland with incidental wildlife uses. Wildlife food and cover would be furnished from field borders, scattered areas of wildlife plantings, and residual grains remaining after harvest. About 20.7 miles of perennial and 6.0 miles of intermittent stream would be retained. The temporary increase in turbidity at times during construction of the dams would not occur.

NONSTRUCTURAL ALTERNATIVES

Accelerated Conservation Land Treatment with Acquisition of Flood Plain Land and Flood Plain Properties - This alternative would include the benefits and impacts of the accelerated land treatment alternative. Acquisition of the 100-year flood plain and associated improvements and an additional acreage consisting of uneconomical remnants would require the purchase of approximately 11,337 acres. These purchases would cost about \$5,843,350.

The removal of 183 agricultural operations from the flood plain would eliminate the present physical damages to these interests. Damages to roads, bridges, and utilities would continue. Farm operating costs would increase, jeopardizing the farmer's competitive position, and increasing the dependence on off-farm income. In some instances, purchase of the flood plain would leave an inefficient unit which would not permit the continuation of the farm at the existing location. This would require the purchase of the entire property and relocation of the operations and families involved to other suitable properties, as required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. These actions would erode the local property tax base and cause social problems which would adversely affect the individuals concerned and the local economy.

Condemnation of some of the properties would be necessary which would also adversely affect the people and the economy.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 159,100 recreation visits annually would not be provided. This alternative would essentially meet the sponsors' objectives for land treatment; however, an additional 1,750 acres of upland converted from pastureland and forest land to cropland would require more intensive land treatment to provide adequate conservation practices for control of erosion and sedimentation problems.

Fish and wildlife habitat conditions would be similar to those described in the "Accelerated Conservation Land Treatment Only" alternative, with some cover lost on the upland and gained in the acquired area.

The flood prevention and sediment reduction objectives of the sponsors would not be met. No provision would be made for the municipal and industrial water.

Flood damages would continue to occur to roads and bridges. The impacts and effects associated with the installation and operation of the structures in the selected plan would not occur.

STRUCTURAL ALTERNATIVES

Accelerated Conservation Land Treatment and Single-Purpose Water Supply Structure - This alternative would include the installation of the accelerated land treatment previously described, and separate development of a water supply system. A structure could be developed on Bush River at the location of damsite 12 to provide the projected demand rate of ten million gallons per day. This would require the purchase of an estimated 880 acres of land. About 6.1 miles of perennial stream and 2.5 miles of intermittent stream would be inundated and a reservoir of 740 acres would be created. The estimated cost of a single-purpose structure would be approximately the same (\$2,452,900) as the cost of the multiple-purpose structure in the proposed project.

This alternative would provide the same reduction in sheet erosion on the uplands as the planned project. A water supply structure on Bush River would trap sediment and reduce downstream sediment damages about the same as the proposed project multipurpose dam 12. The water supply objectives of the sponsors could be met by this alternative. The facilities for an estimated 37,100 recreation visits annually could be provided.

The flood prevention objectives of the sponsors would not be met nor the impacts and effects of increased turbidity associated with the construction and operation of the water supply reservoir be avoided by a single-purpose structure.

Accelerated Conservation Land Treatment and Single-Purpose Fish and Wildlife Structure - This alternative would include the installation of the accelerated land treatment previously described, and separate development of a fish and wildlife lake. A structure could be developed on Briery Creek at the location of damsite 1E to provide the projected water acreage for 122,000 recreation visits. This would require the purchase of an estimated 1,600 acres of land. About 8.7 miles of perennial streams and 1.5 miles of intermittent streams would be inundated and a reservoir of 814 acres would be created. The estimated cost of a single-purpose structure would be approximately the same (\$2,634,450) as the cost of the multiple-purpose structure in the proposed project.

This alternative would provide the same reduction in sheet erosion on the upland as the planned project. A fish and wildlife structure would trap sediment and reduce downstream sediment damages about the same as the proposed project multipurpose dam 1E. The facilities for an estimated 122,000 recreation visits annually could be provided.

The flood prevention objectives of the sponsors would not be met nor the impacts and effects of the multiple-purpose reservoir be avoided by a single-purpose structure.

NO PROJECT

The alternative of no project was considered. This would mean that the structures would not be built and that land treatment would be installed without accelerated technical assistance. The sponsors' existing program of land treatment installation would continue at the present rate at a total cost of \$1,000,000 over a period of about 40 years.

The effectiveness of this alternative in reducing soil erosion would be essentially the same as the "Accelerated Conservation Land Treatment Only" alternative; i.e. a 22 percent reduction, but over a longer period. The landowners would have to delay installation of the land treatment until the staff available to the sponsors could provide them with adequate technical assistance. The time involved in this would be at least 40 years, whereas the proposed installation period would be 7 years.

This alternative would result in further deterioration of resources. Damage to cropland, pasture, and flood plain would continue at a decreasing rate as land treatment is installed under the going program. Net benefits foregone would amount to \$460,070 annually.

Stream flow characteristics would continue to be subject to weather fluctuations, and debris from large storms would continue to cause channel blockage. Sediment would continue to damage flood plains, and road and bridges. Downstream benefits resulting from trapped sediment would not be realized. Economic expansion of the area would not be accomplished at the desired rate because of the lack of a municipal and industrial water supply.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The sponsors' objectives would not be met because land treatment would continue at the present rate, flood damages would continue, and municipal and industrial water would not be available.

This alternative would avoid the loss of approximately 1,959 acres of cropland, pasture, forest land, and wildlife areas that would be covered by the structures and permanent lakes, and the conversion of 1,230 acres of forest and idle land in the protected flood plain to crop and pasture. About 20.7 miles of perennial stream channel and 6.0 miles of intermittent streams would be retained. The increased turbidity associated with the construction activities would be avoided.

SHORT-TERM VS LONG-TERM USE OF RESOURCES

Land use trends in the watershed closely paralleled the national trend in agricultural areas from 1935 to 1964, with land in farms declining steadily. This trend tended to level off in 1969; with about 52 percent of the total county area in farms. During this time the number of farms declined from 1,842 to 610; and the average size farm increased from about 94 acres to 193 acres. This trend toward fewer, and larger, farm units is expected to continue, but at a much slower rate.

Agriculture is expected to remain the dominant segment of the economy in the Bush River watershed for the foreseeable future. Proposed land treatment measures and land use will sustain or increase agricultural productivity to meet the needs for food and other agricultural products. Technical assistance programs will be updated periodically to meet changing local needs and provide the most recent recommendations for use and management of resources, with due consideration for environmental and other values. The projected land use in Bush River is compatible with the projected resource needs anticipated by the Prince Edward County Planning Commission.

The Bush River project area, from a state planning standpoint, composes a portion of Planning District 14, the Piedmont Planning District Commission, the local clearinghouse for planning of land use and resources. The planning district very strongly recommends the protection and wise use of the county's water resources, with well developed plans for potential municipal uses along with fish and wildlife and recreational developments. They are also vitally concerned with protection of the flood plains, natural, and scenic area protection; and fully recognize the value of the county's agricultural lands to the local economy, and the dangers and problems of uncontrolled development.

A Comprehensive Plan for Prince Edward County was prepared in 1973 to aid in guiding the development and land use regulations for the county. Five of the six overall goals, which were given priority for immediate action, have a direct relationship to the P.L. 566 program planned for the Bush River watershed project as a direct implementation measure. The Comprehensive Plan recognizes the significance of land and water resource management as a major factor in overall planning techniques, and to providing the public utilities necessary for the anticipated development.

The Bush River watershed project area is within the Water Resources Council Lower Chesapeake Bay subregion (0208) of the Middle Atlantic Region (02) 1/ which ultimately discharges into the Atlantic Ocean.

1/ OBERS Projections, Regional Economic Activity in the U.S.;
Vol. 3, April 1974, U.S. Water Resources Council, Washington, D.C.

It is in Land Resource area 136, the Southern Piedmont area of the South Atlantic and Gulf Slope Cash Crop, Forest, and Livestock Region 1/.

The recently published James River Basin Survey Report (June 1974) identifies these measures as having potential for development, and recommends they be evaluated for early action as elements of a basin-wide development program.

The structural measures proposed in this project will not solve major environmental problems in the short-term. In fact, pollution problems may occur at times during construction at the various damsites in the form of increased turbidity and sediment load, high noise and dust levels, and smoke from debris disposal. However, measures will be designed and phases of construction controlled, which minimize these adverse effects during project installation. This short-term pollution will cease following installation of the structures.

The project will reduce options for long-term land use only on the land incorporated into the several dams, spillways, and permanent pools, 1,959 acres; inundated perennial streams 20.7 miles; and to a lesser extent 987 acres subject to periodic inundation in the flood pools. The project is compatible with the long-term land use trends of the adjacent land resources, and will build more stability into the local economy. Ground water and air resources will not be impaired.

This planned project provides a level of protection consistent with the needs and objectives of the present and anticipated use of the flood plain land. Installation of the project will effectively alleviate long-term flooding problems downstream, and will provide favorable conditions allowing improved management practices to be initiated on 2,430 acres of agricultural flood plain land. Proper installation of needed land treatment measures over the entire project area will help productivity, preserve the land resources for future use, and aid in solving both short-term and long-term environmental problems. An estimated 1,230 acres of forest and idle land will be converted to crop and pasture in the protected flood plain.

Along with reducing the required maintenance of roads, bridges, and utility crossings at streams, the project's flood protection and sediment storage will reduce the amount of sediment reaching Lake Chesdin, which is located downstream on the Appomattox River. Ten thousand acre-feet of municipal and industrial water supply storage in structure 12 will be available to Prince Edward County to develop the public utilities systems necessary to the service district concept of planned development the county is initiating. Planned fish and wildlife development associated with structure 1E, and incidental recreational use at structure 12, will satisfy much of the expanding recreational requirements anticipated for this area. Each of these long-term resource uses will aid in the orderly development and

1/ Austin, Morris E., Land Resource Regions and Major Land Resource Areas of the United States - Soil Conservation Service, U.S. Department of Agriculture, Agriculture Handbook 296, 1965.

intelligent use of the project area's natural resources, while giving consideration to conservation and environmental measures to preserve the land for use by future generations.

The completed project is expected to be effective in conserving land and water resources long after its designated life of 100 years. The structures will become less efficient as the sediment storage is utilized, and beyond the economic life expectancy of the structures, some of the water supply and fish and wildlife storage will be lost to sediment. Flood protection will not decrease significantly however, due to the high ratio of floodwater storage to sediment storage provided in the structures. Periodic removal of accumulated sediment from the impoundments could restore the efficiency of the structures, allowing them to continue to function indefinitely.

There are two other P.L. 566 watershed projects in the Appomattox River drainage. The project on Buffalo Creek, which enters the Appomattox River about 9 stream miles upstream from Bush River, has been installed and is now being operated and maintained by the Piedmont Soil and Water Conservation District. A project plan has been developed, subject to final approval, on Nibbs Creek, a tributary to Flat Creek, which enters the Appomattox River about 45 stream miles downstream from Bush River. These two watersheds, Buffalo Creek and Nibbs Creek, combined provide for 1,972 acre-feet of sediment storage, 16,026 acre-feet of floodwater detention storage, and 2,000 acre-feet of municipal and industrial storage for local use. The combined watersheds, Buffalo Creek, Nibbs Creek, and Bush River represent about 18 percent of the Appomattox River Basin area that will reflect reductions in erosion, sedimentation, and flooding as a result of P.L. 566 projects. The cumulative long-term environmental effects of these projects along with Bush River will include the improvement of water quality and the quality of fish and wildlife habitat. These amenities are due to the effect of land treatment, establishment of public fish and wildlife and recreation areas, and the reduction in stream turbidity.

Secondary benefits resulting from the project installation will be the establishment of an adequate public water system, including water treatment facilities; and a sport fishery and associated recreational opportunities. An increase in the sales of fishing licenses and retail sales of recreation equipment can also be expected. Traffic will increase on the roads which provide access to the structures which are developed for public fishing and recreation.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Eight structures are planned for the project. In addition to floodwater and sediment, one structure will contain storage for municipal and industrial water supply and one will contain storage for fish and wildlife development. The remaining six structures are planned as single-purpose floodwater retarding structures. The acreages to be committed to the construction of dams, emergency spillways, sediment pools, municipal water supply, and fish and wildlife pools total approximately 1,959 acres. As a result of flood-producing storms, there could be as many as 987 additional acres temporarily inundated within the flood storage pools. This land will also be committed to the project since it is subject to periodic flooding. Restrictions upon it will be the same as on the 100-year flood plain. The total committed acreage is 2,946 acres, about 3.0 percent of the project area. The table at the end of this section gives a distribution of the current land use of acreages committed to the project. There will also be some restrictions in the use of another 130 acres in the emergency spillway storage areas.

A total of 20.7 miles of perennial streams will be inundated by the eight structures and their associated permanent pools. During periods of flood storage, additional amounts of stream channel will be temporarily inundated. After completion, the structures and their associated reservoirs will have created a total of about 45.6 miles of shoreline, and will possess some intrinsic value.

All land areas developed with federal cost-sharing assistance, in accordance with Public Law 566, must remain in the planned use throughout the evaluated life of the project. They may, however, be assigned to another public agency which may incorporate the project into its framework of operation, but must continue to operate and maintain the project for its intended function.

The financial and labor resources invested in the installation of this project will be irretrievable over the short term. However, with a favorable benefit-cost ratio, this investment will be recovered through reduced costs and realized opportunities during the project's economic life. The total expended for project installation costs, approximately \$6,663,250 including labor and materials required for construction, will not be immediately available for other local and national uses. Only the concrete, reinforcing steel, pipe, and the fuel and manpower resources expended during the construction of the proposed structures will be totally irreversible or irretrievable over the long term.

ACRES COMMITTED TO THE PROJECT

		Committed Acres of				
				Forest		Percent
Site		Crop-		Land &	Sub-	of
No.	Project Use	land	Pasture	Other	Total	Total
	Dam & Spillway	0	0	19	19	
1E	Sediment Pool	5	0	130	135	
	Fish & Wildlife					
	Storage	13	2	664	679	
	Flood Pool	21	2	211	234	
Briery Creek	Subtotals	39	4	1,024	1,067	36.2
	Dam & Spillway	0	0	10	10	
2	Sediment Pool	0	0	26	26	
	Flood Pool	0	0	56	56	
Rice Creek	Subtotals	0	0	92	92	3.1
	Dam & Spillway	0	0	9	9	
3	Sediment Pool	3	0	47	50	
	Flood Pool	4	2	37	43	
Cunningham Creek	Subtotals	7	2	93	102	3.5
	Dam & Spillway	0	0	14	14	
4B	Sediment Pool	16	17	67	100	
	Flood Pool	18	4	163	185	
Mountain Creek	Subtotals	34	21	244	299	10.2
	Dam & Spillway	0	0	7	7	
5	Sediment Pool	4	0	13	17	
	Flood Pool	0	0	33	33	
Camp Creek	Subtotals	4	0	53	57	1.9
	Dam & Spillway	0	0	15	15	
6	Sediment Pool	0	16	25	41	
	Flood Pool	0	8	51	59	
Evans Creek	Subtotals	0	24	91	115	3.9
	Dam & Spillway	7	0	12	19	
7	Sediment Pool	12	11	30	53	
	Flood Pool	0	9	74	83	
Bush River	Subtotals	19	20	116	155	5.3
	Dam & Spillway	0	5	29	34	
12	Sediment Pool	11	38	171	220	
	Municipal Storage	94	56	370	520	
	Flood Pool	26	38	221	285	
Sandy River	Subtotals	131	137	791	1,059	35.9
Total		234	208	2,504	2,946	100.0
Percent of Total		7.9	7.1	85.0	100.0	

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

General

Activities leading to the development of the project began with the application for assistance sponsored jointly by the Piedmont Soil and Water Conservation District, and Prince Edward County Board of Supervisors in 1967. The application was approved, without priority, by the Virginia Soil and Water Conservation Commission in June 1967. A priority was established by the State Commission in April 1970, after consideration of sponsors' objectives. Planning authority for development of a watershed project plan was issued by the Administrator of the Soil Conservation Service in July 1970. In June 1973, at the request of the Piedmont Soil and Water Conservation District and Prince Edward County Board of Supervisors, the Virginia Commission of Game and Inland Fisheries was added as a cosponsor of the project. This sponsor was added so that it could more actively participate in the sponsors' plans for development of fish and wildlife and recreation project objectives.

At the time planning authority was issued the following agencies were notified of intentions and were requested to furnish any comments or suggestions they might have concerning the project:

United States Army Corps of Engineers
United States Department of Agriculture
Agricultural Stabilization and Conservation Service
Farmers Home Administration

United States Department of Health, Education, and Welfare
United States Department of the Interior
Fish and Wildlife Service
Bureau of Mines
Bureau of Outdoor Recreation
Geological Survey
National Park Service
United States Environmental Protection Agency
Cooperative Extension Service
Piedmont Planning District Commission (area-wide clearinghouse)
Virginia Department of Highways and Transportation
Virginia State Archeologist
Virginia Historic Landmarks Commission
Virginia Department of Conservation and Economic Development
Virginia State Water Control Board
Virginia Commission of Game and Inland Fisheries
Virginia State Department of Health
Virginia Division of Water Resources
Virginia Soil and Water Conservation Commission
Virginia Division of Forestry

Virginia Commission of Outdoor Recreation
Virginia Department of Agriculture and Commerce
Virginia Division of Planning and Community Affairs (state clearinghouse)

Information from the U.S. Fish and Wildlife Service was used in describing the fish and wildlife values and their potential. In order to more actively participate in the sponsors' fish and wildlife development, the Virginia Commission of Game and Inland Fisheries became a cosponsor of the project. A representative of the Fish and Wildlife Service and an SCS biologist made a field study of the land use change impact areas below the proposed structures. A field coordinator for the Commission made an independent study.

The U.S. Army Corps of Engineers replied that: "These structures are at an elevation higher than anything this office is likely to consider in its comprehensive plan for development of the James River Watershed. Accordingly, we have no objection to this study."

The Virginia Department of Highways and Transportation was consulted concerning roads affected by the structures. A special study was made to determine the size of drainage structures needed to raise these roads above a given elevation, and the depth and duration of flooding for selected frequencies. This information was furnished to the hydraulics section for use in making cost estimates for roadway adjustments required.

The Virginia Commission of Outdoor Recreation replied that multiple-purpose structure 1E on Briery Creek is identified in the Virginia Outdoors Plan, 1974, as a potential public fishing lake and expressed the hope of close cooperation with the Virginia Commission of Game and Inland Fisheries in this development. They also stated that: "As in the past when we have commented on the watershed planning assistance proposals, we stated that we would be opposed to structural improvements such as stream channeling or straightening which would have serious adverse effects upon stream ecology. We would hope that the environmental impact of any structures or stream modifications would be studied as part of your planning program."

The Federal Water Pollution Control Administration (now EPA) replied that they were not aware of any water quality problems in the basin. They requested that they receive any additional information developed during planning on the location and purposes of the proposed impoundments.

The Virginia State Water Control Board and the United States Environmental Protection Agency provided information relating to water quality.

The National Register of Historic Places lists three historical sites in Prince Edward County, two of which are within the watershed boundary. The Virginia Historic Landmarks Commission made a study of the watershed area in which they listed three additional

places of historical interest 1/. None of the above places will be adversely affected by the actual installation of this project.

The State Archeologist was consulted and a study is currently underway. Results of this study will be available for use in preparing the final environmental impact statement.

The National Park Service was notified with respect to the project in compliance with the National Historic Preservation Act of 1960 (80 Stat. 915) and Public Law 86-523, 86th Congress S. 1185, 197.

The National Park Service and the Virginia State Archeologist will be notified if any previously unidentified evidence of cultural values are discovered during detailed investigations or construction in accordance with the Archeological and Historical Preservation Act (P.L. 93-291). Any planned recovery, protection or preservation operations will also follow procedures in P.L. 93-291. Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources. Provisions of the Reservoir Salvage Act will also be followed where applicable.

Publications and other data from the Virginia Division of Planning and Community Affairs provided information relating to economic data, ground water resources, mineral resources, public utilities, population projections, transportation, and general area data.

Topographic maps and surface water data published by the U.S. Geologic Survey provided basic watershed information. All information received from these agencies, and other agencies and individuals, was considered during development of this plan.

Between March of 1967 and December 1974, 84 news articles and 38 pictures totaling approximately 1,050 column inches have appeared in local newspapers relating to activities in the Bush River watershed. Two thousand pamphlets and other communications have been distributed through 56 civic organizations and clubs to inform the people of progress of the studies and evaluations. Eight public meetings were held to inform the public as to what the project would offer, and to seek their views on the project.

Letters of endorsement have been received from the Farmville Area Development Corporation, Hampden-Sydney College, Longwood College, the Town of Farmville, Farmville Chamber of Commerce, several local businesses and individuals. The local radio station has carried both news reports and feature programs about this project. These letters, reports and meetings set forth the environmental, esthetic, economic, and social values of concern to the area.

1/ Letter from Virginia Historic Landmarks Commission dated March 14, 1975.

DISCUSSION AND DISPOSITION OF EACH COMMENT ON DRAFT ENVIRONMENTAL STATEMENT

The agencies which responded to a request for comments on the draft environmental impact statement and plan follow:

Department of the Army
Department of the Interior
Department of Transportation
Environmental Protection Agency
Council on the Environment, Office of the Governor, Commonwealth of Virginia compiled the comments from the following State Agencies:

Virginia State Water Control Board
Virginia Department of Health
Virginia Air Pollution Control Board
Virginia Soil and Water Conservation Commission

Virginia Soil and Water Conservation Commission

Agencies and groups which did not respond to a request for comments on the draft environmental impact statement and plan follow:

Council on Environmental Quality
Department of Commerce
Department of Health, Education, and Welfare
Federal Power Commission
Office of Equal Opportunity
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project

Summary of Comments and Responses

Each issue, problem, or objection is stated and a response given on the following pages. The comments are serially numbered where agencies have supplied multiple comments. The original letters of comment appear in Appendix C.

Department of the Army

- (1) Comment: We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

Response: Thank you for your review and concurrence.

- (2) Comment: The Virginia State Conservationist should be informed that regulatory permits will be required for work that affects navigable waters and requests for such permits should be made to the Norfolk District Office of the Corps of Engineers at the earliest possible data.

Response: Agreed. The State Conservationist has been notified.

Department of Transportation

- (1) Comment: The concerned operating administration and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

Response: Your review and concurrence in this project is appreciated.

Department of the Interior

(A1) Comment: We are pleased to note that the plan does not include any of the stream alteration features which were previously under consideration.

Response: Stream alteration was considered but was rejected. Difficulties of designing a stable earth channel within economic constraints precluded stream alteration as an alternative.

(A2) Comment: In accordance with Section 12 of the Watershed Protection and Flood Prevention Act, we strongly recommend your consideration of the following:

1. Access, in fee or easement, be provided at each impoundment;

Response: In accord with Soil Conservation Service policy, potentials for fish and wildlife and recreation use were appraised for all reservoirs in the watershed project. Findings were discussed with the sponsors. Analyses of potentials included determination of landrights needed for public access, sanitary, pollution control, recreation, and safety facilities needed for public use. The sponsors elected to provide for public recreation at site 12. Site 1E includes fish and wildlife use as a project purpose and provides for public access and use. The sponsors decided to preclude public access and use at sites 2, 3, 4B, 5, 6, and 7. See page II-15 for amplification.

(A3) Comment: and standing timber be left in shallow water areas (depth less than or equal to six feet) in all proposed reservoirs.

Response: Section 12 of P.L. 566 provides for the Secretary of Interior to prepare a report which may include findings and recommendations. SCS has not received such a report. SCS and the local sponsors agree that without substantiating data as would be included in the report, the relative merits of the proposal from an engineering, wildlife, and environmental standpoint cannot be determined.

(B1) Comment: Fresh water fishing demands by regions for the State of Virginia are shown in Volume II of the "Virginia Outdoors Plan, 1970." The plan indicates that fishing demand in this region will more than triple by the year 2020. Unfortunately, according to the draft statement, page II-15, the general public will be prohibited from using sites 2, 3, 4B, 5, 6, and 7. Furthermore, public access to the available fishing sites on 1E and 12 will be limited to road crossings.

Response: Public access will be provided at five areas for site 1E. See Appendix H-1. Access will be provided at two areas of site 12. See Appendix I.

(2) Comment: Additional information should therefore be provided in the final statement as to why the project sponsors decided not to allow more public access. Monetary expenditures necessary to provide the bare essentials at each site and what effect this would have on the benefit cost ratio should also be discussed both here and in the work plan.

Response: The decision to provide for or prohibit general public access to sediment or water supply pools is the responsibility of the sponsors. See page II-15, last paragraph. The decision was arrived at after such considerations as site location, topography, accessibility, cost of providing access, expected use, cost of sanitary facilities and operation and maintenance.

(3) Comment: It is stated on page II-16, paragraph 3, that a bottom release will be installed in these structures. The effects of cold deoxygenated waters released from a potential hypolimnion should be discussed with respect to tailwater fishery resources. The possibility of lake stratification should likewise be discussed.

Response: Provisions have been made for these structures to release minimum flows as required by Virginia state law. Such flows will be released from a selected depth near the surface so as not to release cold deoxygenated water. The third paragraph, page II-16, and other sections of the plan and EIS as appropriate, have been modified by changing them to read: "Provisions have been made for the release of flows from near the top of the permanent pool. Openings in the risers will be sized to release amounts up to normal flow."

The average depth of the single-purpose reservoirs ranges from 5.0 to 5.8 feet which reduces the probability of lake stratification. The Virginia Commission of Game and Inland Fisheries and the Prince Edward County Board of Supervisors have resolved to operate sites 1E and 12, respectively, in accord with State Water Quality Standards.

- (4) Comment: Woodland improvement mentioned in this section includes removal of non-merchantable or unwanted trees, shrubs, or vines. This practice can be very detrimental to the well being of forest dwelling wildlife species. Many times non-merchantable trees contain cavities which provide nests and shelter for a number of species, including squirrels, raccoons, screech owls, and woodpeckers. Removal of vines and shrubs having no commercial timber value will substantially reduce the carrying capacity of such habitats for deer and turkey, which depend on understory species for food. These impacts should be addressed in the environmental impact section.

Response: Timber Stand Improvement is felt to be more descriptive of the type of work recommended in this Plan. It should also be noted that planning and installation of this practice under the supervision of a professional forester takes into account the needs of the total forest resources, including wildlife habitat. Impacts may range from detrimental to enhancement depending upon (1) the objectives of landowners, (2) the present status and capability of habitat and (3) the species and population of wildlife concerned.

- (5) Comment: An evaluation of cultural resources is presently being accomplished in coordination with the Virginia Historic Preservation Officer. This official's approval of the evaluation should be documented. The final statement should include a complete discussion of potential project impacts on cultural resources in relation to alternatives considered.

Response: The Virginia Historic Preservation Officer's report shows that the project as proposed will have no adverse effect on cultural resources. The alternatives considered would have no significant adverse effect.

- (6) Comment: The Advisory Council on Historic Preservation should also be consulted if the undertaking will have an effect upon properties on or eligible for inclusion on the National Register of Historic Places.

Response: The project will have no effect on properties on or eligible for inclusion on the National Register of Historic places. See page II-16.

- (7) Comment: It is noted that "the State Archeologist is conducting the field examination and the result will be available before preparation of the final environmental statement" (page II-48). Professional archeological supervision should also be exercised as work progresses. The contract with the excavator should include a stop-work clause to provide for archeological salvage of any evidence encountered.

Response: All work areas will be monitored by SCS inspectors during construction. The contract will contain a stop-work clause which will allow for salvage of archeological resources. See page II-16, paragraph 2.

- (8) Comment: Page II-48 notes that Linden "...a late 18th Century frame house located off State Route 630...has been torn down and removed..." If this removal was accomplished in relation to this project, an assessment should be made thereof with the approval of the Virginia Historic Preservation Officer. The historic value of the property should be assessed in relation to the possibilities of archeological salvage.

Response: The removal was not project induced.

- (9) Comment: Ground water is discussed on pages II-37 and II-59. We suggest in addition that the more prolonged effects on ground-water levels in the vicinity of the multiple-use structures and the temporary effects in the vicinity of flood retardation structures should be considered, as should the effects of land treatment on recharge to ground water.

Response: A continuous supply of water in the sediment and multi-purpose pools will raise water table levels in small areas adjacent to the permanent pools and downstream of the dam. This will result in a minor amount of local swamping. The pools will also tend to recharge ground water. The general impermeable nature of the surrounding rocks will prevent flood storage water from having an unfavorable effect.

Land treatment measures will deter runoff and allow greater infiltration thereby having a favorable effect on ground water recharge and return flows.

- (10) Comment: On page II-68, a reference is made to specific reductions in sediments entering the navigable channels of the James River. However, no data are presented to show the expected increases in sedimentation due to construction and increased cultivation on the flood plain. These increases in sedimentation should be discussed with respect to their effects on fish and wildlife resources. An adequate discussion of these effects was noted on pages II-57 and II-58 (Water and Related Land Resource Problems). This discussion should also be included in the environmental impact section.

Response: It is felt that reproduction of the material presented on pages II-57, II-58 might be unnecessarily repetitious and essentially a restatement of the problem. The following statements have been added to page II-68 in lieu of the proposed statements: "Sediment reduction will beneficially effect stream biota. Light will better penetrate the water, growth of stream bottom organisms will improve as will oxygenation. There will be less sediment to cover fish and other eggs and damage fish gills. Other sediment damages to aquatic flora and fauna will be reduced."

Current and expected loadings during and after construction are shown for each site and are discussed generally on pages II-13 and II-14. The increased loading during construction will have some short term detrimental effects in the reach below the site. Turbidity will increase at times during construction causing a slight increase in damage to fish gills, eggs and other aquatic flora and fauna.

If the project is installed, flooding and scouring of the flood plain will be reduced approximately 40 percent. Therefore flood plain soils will not be lost through erosion to the degree they would without flood protection. Planned land treatment and structural measures are estimated to reduce the amount of sediment leaving Bush River by 39,018 tons annually.

- (11) Comment: It is stated on page II-69 that the two impoundments open to the public for fishing will result in 159,100 user-days annually. It is unclear whether this figure signifies recreation user-days, which would include picnicking, camping, boating, and other uses, or whether it indicates fisherman user-days. This point should be clarified in the final environmental statement.

Response: The 159,100 user-days includes all recreation activities. It is an adjusted figure. A user-day may reflect one, two, or more recreation activities.

- (12) Comment: On page II-69, paragraph 3, it is stated that wildlife habitat will be protected from future development in the flood pool. Does this mean that there will be no farming or timber harvesting in the flood pool? The expected uses of these areas should be addressed, and the statement concerning the protection of wildlife habitat should be substantiated.

Response: The statement does not mean there will be no farming or timber harvesting in the flood pool. The second whole paragraph, page II-70 shows that 87 percent of the flood pools are wooded. Flowage easements and the Virginia Building Code will preclude residential or urban development. Land use in the flood pools will remain essentially unchanged. To the extent that the stated restrictions maintain the present land use, wildlife will be protected in the flood pools.

- (13) Comment: The standing timber left in the flood pool and shallow areas of the permanent reservoirs will benefit the fishery and riparian wildlife, especially wood ducks. Was this considered as a mitigating feature of the proposed project. The second paragraph on page II-70 states that 43 acres above the flood pool will be cleared. An explanation of the reasons for this clearing should be given.

Response: See response to comment number A3. This feature was not considered as a mitigating measure. The project will have no significant adverse impact on this type of wildlife habitat. The 43 acres referred to here is a narrow strip around the rim of the permanent pools. This is necessary to prevent dead trees and trash from clogging the spillway inlet and causing possible damage to the structure.

- (14) Comment: This section should discuss the possibilities of implementing dry-bed reservoirs as an alternative to single-purpose flood water retarding reservoirs. The effects of dry-bed reservoirs on fish and wildlife resources should be discussed. The section should also discuss the alternative of providing public access to all impoundments.

Response: This section is normally for discussion of alternatives to the selected plan. Consideration of methods of implementing the selected plan usually occur during the planning phase, after the plan is selected. However, dry storage of sediment was considered and rejected. It was felt that the overall beneficial effect of wet storage of sediment far outweighed the adverse effect. See the listing of effects on pages II-74, II-75. As to dry storage, except for more frequent flooding, the impact on wildlife in the (permanent pool) area would be essentially the same as for the flood pool. See pages II-69, II-70, and response to comment 12.

Public access is a consideration in implementing the selected plan, not an alternative to it. Public access was addressed in response to comment number A1.

(15) Comment: This section should include a discussion of any changes in wildlife habitat along the flood plain which are expected to occur as a result of the project.

Response: The following was added as a paragraph on page II-69: "Completion of the project will provide for more efficient management by farm operators and other landowners on about 2,000 acres of the 3,812 acres of protected flood plain. A total of 77 present landowners will directly benefit from flood prevention as a result of the project. This will result in the conversion of an estimated 1,230 acres of forest and idle land to crop and pasture and other uses. Presently, this land is covered with brush or young trees and was recently in cropland. This conversion in the protected flood plain will reduce cover and increase food supplies for forest wildlife." Page II-75 - a statement was added under Adverse Environmental Effects that 1,230 acres of forest and idle land in the protected flood plain will be converted to cropland and pasture. On page II-79 under No Project, last paragraph, a similar statement was made. Page II-81, the fifth paragraph under Short Term vs Long Term Use of Resources, similar statements were made.

U.S. Environmental Protection Agency

- (1) Comment: On page I-20, \$1.00/visit is subtracted from the gross benefits on Structure 12. The same procedure is not utilized for site 1E. An explanation should be furnished for not subtracting a like amount from the gross benefits on Site 1E.

Response: Fish and wildlife use of Structure 12 will be a non-project feasture, only incidental to the project; as no storage was included for this purpose. Estimated benefits were reduced \$1.00 per visit to provide for installing as non-project features such items as parking lots, access to the lake and other necessary facilities, and their operation and maintenance; to make possible this incidental use of the lake.

One of the project purposes of Site 1E is fish and wildlife development; with 12,254 acre-feet of storage and associated facilities part of the planned project measures. Fish and wildlife benefits for Site 1E are part of the planned project benefits. The costs for installation of fish and wildlife development features and facilities in Site 1E were included as project costs in Tables 1, 2, and 2A (Pages I-27, I-29 and I-30), and their operation and maintenance in Table 4 (Page I-33). Therefore a reduction of these benefits for Site 1E was not necessary to properly reflect evaluation of the planned project.

- (2) Comment: One concern is the proposal for water supply storage. On page II-58, reference is made to Buffalo Creek in supplying the drinking water to Farmville. Plant capacity is 1.1 MGD with consumption from 0.6 to 0.75 MGD. A proposed project alternative may call for expansion of existing facilities at Buffalo Creek to meet future water demands. The raw water may be taken from Buffalo Creek or the Appomattox River.

Related to the above problem is the apparently inflated future water demands given on page II-60. In the period from 1975-2020, the total water needs are projected to double. But in that same time span, the population is expected to increase about 10% and the water users may increase 20% as indicated on pages II-39 and II-72, respectively. Justification of these projected water needs should be presented.

Response: A study of the flow characteristics for the Appomattox River gage at Farmville and the Buffalo Creek gage at Hampden Sydney shows that these two streams will not meet the combined future needs of Farmville and Prince Edward County without impoundments on one or both streams. The low flow recorded for the Appomattox River gage, which includes Buffalo Creek, is 2.46 m.g.d.

The future water needs were taken from the consulting engineers report prepared for Prince Edward County. The figures for domestic and industrial uses were obtained from the State River Basin Water Quality Plan 1/, while estimated agriculture needs were furnished by the Soil Conservation Service from Conservation Needs Inventory data. Population figures for Prince Edward County (including Farmville) are estimated to increase from 15,000 to 23,000 (53 percent) during the 1975-2020 time span (see page II-39). Total needs during this period are expected to increase about 100 percent. Domestic consumption is scheduled to increase the most during this period, or about 200 percent, since future growth will be governed to a large extent by the availability of a public water supply.

There may be some lag in actual water consumption versus projected needs, especially during the early stages of development. This situation is expected to change however, as the service area is expanded to include a larger percentage of the total county population (see page II-72). The total demand rate should equal or exceed the projected figures during the 100-year project evaluation period.

- (3) Comment: The current reference for classification of Virginia waters is the 1974 not 1970 publication as cited on page II-38.

Response: Agreed. Page II-38 has been changed to reflect the correct data.

1/ State Water Control Board Planning Bulletin 269, James River Basin, 1972.

- (4) Comment: On page II-60, it is related that the nearby state park facilities are "filled to capacity." Does this refer to all activities or camping facilities only?

Response: The reference is to normal weekends during the peak season. Reservations are made on picnic shelters and camping facilities.

- (5) Comment: Reservoir location #12 is proposed as a water supply system. Benefits derived from the project include industrial growth due to increased availability of water. We recommend that any site acquisition study, for industrial operations, consider the maintenance of water quality and quantity downstream of the site. Water impacts may be severe during low flow periods when a significant percentage of stream flow is diverted through industrial systems, and discharged as polluted effluent.

Response: Future industrial growth is expected to occur as a result of M&I water storage in site 12. Such industries will be required to obtain a permit from the Virginia State Water Control Board before pollutants can be discharged to the stream. This permit program is required by the National Pollutant Discharge Elimination System, which was established by the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). In view of the State Water Control Board Regulation No. 6, which governs the above act, it seems only reasonable that any site acquisition study for industrial purposes would consider both the quality and quantity of downstream flows as a part of their economic justification process.

- (6) Comment: A discussion of land value is found on page II-52. In particular, the statement claims that one acre of floodplain is worth two acres of upland. Are there any data to support this claim? If so, it should be referenced in the EIS.

Response: The last sentence in the first paragraph on page II-52 states that: "In addition to being more erodible, about two acres of upland are needed to replace the production of one acre of flood plain." This is not related to dollar value or selling price placed on the land. Interviews with local land-owners and professional agricultural workers during project investigation revealed that the flood-free yields of cultivated crops from one acre of flood plain land would equal that produced by two acres of upland under a comparable level of management.

Due to the flood hazard, farm operators have had to abandon large areas of flood plain over the last 30 years. This has caused the clearing of many more acres of upland by these operators to meet their needs for such crops as corn, soybeans, silage, and to some extent small grain crops. This not only increased operating costs, but aggravated an undesirable land resource management problem.

- (7) Comment: What will be the impact of the 520 acres of mudflats on public health and water quality (page II-69)?

Response: A water budget analysis, based on the Appomattox River gage at Farmville, indicates two severe drought periods for the 47 years of record available. A total of 520 acres would be exposed during the most severe drought period, with a combined draft rate (M&I water plus downstream release) of 11.63 mgd. One-half of this area would be exposed for a period greater than 18 months, while only 30 acres would be exposed for a period greater than 3 years. A flow duration analysis shows that this draft rate would be exceeded about 60 percent of the time, which means that drawdown of the water supply pool only occurs when streamflow is much below normal. The average land slope within the drawdown area is 5.6 percent. In view of the above considerations, we do not anticipate a significant impact either on public health or water quality.

- (8) Comment: We recommend that all flood control structures have dry pools rather than small pools that may become a health or water quality nuisance.

Response: The flood control reservoirs are not expected to become a health or water quality nuisance. Existing water quality is good in the watershed with high dissolved oxygen and low fecal coliform and nutrient levels. See 4th paragraph, Page II-38 and Appendix G. The Virginia State Water Control Board classifies Bush River as III-A "waters generally satisfactory for use as a public or municipal water supply, secondary contact recreation, propagation of fish and aquatic life, and other beneficial uses." The sediment pools for the flood control structures vary from 17 acres to 100 acres in size.

Commonwealth of Virginia, Office of the Governor, Council on the Environment

State Department of Health

- (1) Comment: Additionally, the State Department of Health has reported their endorsement of the project subject to the condition that water withdrawal structures at Site 12 contain multiple outlets at various depths to meet the Waterworks Regulations. That department also would like to review plans for the outlet structure for any proposed water treatment plant prior to construction.

Response: Prince Edward County has resolved to use such powers as are within their means to comply with State Water Quality Standards in the operation of site 12. Plans for any water treatment plant in conjunction with site 12 will be the sole responsibility of Prince Edward County. The county agrees to submit the plans for review.

State Air Pollution Control Board

- (1) Comment: The State Air Pollution Control Board has notified us that, while the project should have no permanent impact on air quality, state regulations governing open burning and fugitive dust must be complied with during the construction phase of the project.

Response: The first paragraph, page II-13, has been changed to read, "Contractors will be required to comply with the provisions of the Construction Safety Act of 1969 (PL-91-54) and applicable state regulations governing open burning and fugitive dust."

State Water Control Board

- (1) Comment: As indicated in the subject report (Section II, page 21), proposed Reservoir 12 will thermally stratify with the "hypolimnion becoming anoxic during the warm, lowflow, summer months." The report also states that "a 12 inch slide gate located five feet above the base of the riser in addition to the water supply gates will serve the function of flow management (Section II, page 21)."

There is "no information provided which indicates the modus operandi of the aforementioned gates for regulation of the dissolved oxygen and temperature of the releases. If water is withdrawn exclusively from the hypolimnion, the low D.O. content of the releases could have possible detrimental impacts on downstream biota of the Sandy River.

To assure compliance with Virginia Water Quality Standards, a program for water quality regulation and monitoring of the releases should be developed for Reservoir 12.

The problem of stratification should be addressed for each of the other seven proposed reservoirs, particularly, for proposed Reservoir 1E.

Response: The Prince Edward County Board of Supervisors have resolved to use any such powers vested in the county to comply with State Water Quality Standards in the operation of structure 12. The Virginia Commission of Game and Inland Fisheries have made a similar commitment for operation of structure 1E. Letters are on file in the SCS State Office.

The State Water Control Board has been consulted in this matter and may assist the sponsors in developing guidelines for operation of the reservoir.

(2) Comment: The subject document indicates that one of the major functions of the proposed reservoirs is storage for sediment entering the Bush River Watershed from various land disturbing activities. Associated with the influx of sediment to the reservoirs will be nutrients from non-point sources, i.e. fertilizers from farmlands and nitrogenous wastes from pastureland. (An additional source of nutrients will be fertilizers applied in establishment of vegetative land treatment measures in the watershed above the reservoir.)

In view of the continued importance of farming and grazing activities in the Bush River Watershed, nutrient enrichment of proposed reservoirs seems likely. Coupled with sedimentation, this nutrient enrichment will accelerate the eutrophication of the reservoirs, eventually, causing the appearance of algal blooms and a reduction of dissolved oxygen concentrations.

Eutrophication would severely impair the viability of Reservoir 12 to function as public water supplies and would negate the attractiveness of reservoirs for public recreation. In addition, the releases

from the dams would have lower dissolved oxygen concentrations, thus, affecting downstream water quality.

Response: According to Cornell University researchers 1/: "The movement of sediments and phosphorus into waterways depends more directly on the nature of the surrounding landscape than on the extent of agriculture in the watershed."

"Those lands in our study that were most intensively farmed contributed the least phosphorus to the waterways," they said. "On the other hand part of the watershed that was farmed lightly contributed disproportionately high amounts of phosphorus and sediments." They also reported that "the most crucial factor determining the degree of phosphorus pollution and sedimentation was the slope of the farmed land." 1/

If the project is installed, flooding and scouring of the flood plain will be reduced approximately 40 percent. Therefore flood plain soils will not be lost through erosion to the degree they would without flood protection.

Planned land treatment and structural measures are estimated to reduce the amount of sediment leaving Bush River watershed by 39,018 tons annually.

"All of this erosional sediment cannot be attributed to agricultural endeavors. Approximately 30 percent of this sediment is classified as natural or geologic in origin. Less than 20 percent of erosional sediment originates from industrial, municipal, and individual activities. The remaining sediment, at least 50 percent is due to agricultural activities." 2/

"Soil Conservation practices can reduce the sediment loading of our waters, the losses of our valuable topsoil, and the flooding and swamping of downstream areas. Sediment yield reductions of 50-98 percent have been reported from improved watersheds." 2/

Observations and studies conducted by SCS indicate accelerated eutrophication of the reservoirs will not take place.

- 1/ Runoff Sources Pinpointed, New York State College of Agriculture and Life Sciences a Statutory College of the State University, Cornell University Press Service, Roberts Hall, Ithaca, New York 14850.
- 2/ Water Resources Bulletin, Volume 6, No. 1, January-February 1970, Sediment in Relation to Water Quality, E. H. Grissinger and L. L. McDowell.

- (3) Comment: To minimize sedimentation, construction of the dams and reservoirs should be scheduled for the dry months of the year. Furthermore, cofferdams should be placed downstream from each of the 8 construction sites, to minimize the effect of earth disturbing activities on downstream turbidity.

Response: All practical methods to control erosion during construction will be considered. Site conditions, time of year and type of construction activity will dictate specific practices. Page II-13 addresses this problem.

- (4) Comment: The project was submitted by the sponsors in 1967, but neither the draft plan nor the DEIS mentions or evaluates projects that have been proposed or approved since that time. Some recent projects which could have a significant effect upon the plan are the Farmville Water Treatment Plant currently under construction, and the proposed Nottoway Falls Recreation Area.

Response: Known projects that might have an effect on the plan were considered during the planning phase. The need and amount of water to be stored in site 12 was a local determination made with full knowledge of the Farmville water treatment plant. The County considered the Farmville supply as an alternative and concluded that it was inadequate for the total county and city needs.

Recreation and fish and wildlife needs were estimated in consideration of existing and probable facilities. The projected demand for recreation facilities cannot be met by the plan proposal.

- (5) Comment: Sediment control is a primary goal of the project. An important consideration in attaining this goal is the relationship between sediment transport and erosion. Because the rate of erosion is inversely proportional to the sediment load, an environmentally favorable balance must exist between the two. Such a balance should achieve minimum stream scouring and erosion at a minimum sediment load. The total sediment damage to the James River Basin and the project's ability to reduce sediment damage appear to be overstated. The entire James River Basin comprises 6,442,000 acres and Bush River comprises 98,700 acres or 1.5 percent of the total. The damage which the basin, by project estimate contributes amounts to seven percent of the total damage

to the entire basin, estimated at \$3 million by the USDA. Broken down by acre, each acre of the James Basin contributes \$.47/year of sediment damage to the total basin, but each acre on the project basin contributes \$.86/year of damage. The basin's flood plain slope averages from one to three percent, and the uplands average from six to fifteen percent. If the estimated \$114,540 sediment damage reduction is correct, it would mean that the project would reduce sediment damage in the James Basin by almost four percent per/year, a figure which we believe is too large. We also question the sediment damages (about \$197,240 annually) estimated to occur in Lake Chesdin and navigable channels of the Appomattox and James Rivers as consequence of the influx of sediment from the Bush River Watershed. Was the estimate of sediment reaching the navigable channels based on actual field data?

Response: The amount you have quoted ".47/year sediment damage" is an average figure for the whole James River Basin. The .86/year for Bush River is a specific amount computed for an area that has soil types that are more erosive and crops such as tobacco which is not conducive to the best conservation practices. The damage and benefit calculations were based on sediment removal and disposal estimates obtained during project evaluation. Consideration was given to time intervals for removal and present values of estimated costs at that time.

Sediment calculations were based on information available and prior experience on similar watershed.

(6) Comment: The plan projects a domestic water supply demand of 3.7 MGD by 2020. This figure appears to be overstated when compared to the PDC's M/R Plan which projects a demand of 2.1 MGD in 2000. The subject report projects 2.7 MGD for the same year. If the PDC's figures are projected at a constant rate for 20 years to 2020, the domestic water demand is 2.7 - 2.9 MGD to 3.7 MGD, a difference large enough to warrant re-evaluation.

The total water supply demand is estimated at 11.06 MGD by 2020; that could be supplied by a reservoir with a storage capacity of 10,000 acre/feet. Of this demand, only 3.7 MGD is consumed in domestic use; the remainder is projected for agricultural and industrial use, a use which normally does not require treated water.

An alternative which should be evaluated is the Farmville Plant, currently under construction with a raw water intake on the Appomattox River. The plant will have an initial capacity of 3 MGD with the capability to expand upward to 12 MGD.

Based on the 1-day, 30-year low flow at Farmville, the system may withdraw about 5.4 MGD of which about 85 percent is returned. By using two intakes, one at Farmville and another downstream, the region could expand its water withdrawals to approximately 9.9 MGD and remain within the limits of the 1-day, 30-year low flow.

Page I-19 contains the statement: "Benefits to municipal and industrial water storage amount to \$138,970 annually based on alternative development costs provided by the consultants." This statement would be more understandable if staff knew what alternative sources are being used in comparison.

Response: Domestic water supply demands were a local determination. See also response to comment number 4 and EPA comment and response number 2.

- (7) Comment: The distribution of benefits seems to be weighted in favor of private landowners. Access to sites 2-7 will be largely restricted to adjacent property landowners.

Response: Direct benefits arising from flood protection will accrue largely to private landowners. These benefits amount to 38.8 percent of total direct project benefits and 35.5 percent of total direct and secondary benefits.

General public access to sites 2, 3, 4B, 5, 6, and 7 will be prohibited by the local sponsors. See also response to USDI comment number A2.

- (8) Comment: The plan states that implementation will cause a rise in family income of \$1,500 per year. How was this figure determined? No supporting data is provided. Based on the PDC's 1970 estimates of 3.1 persons per household, the project would have to generate increases in income in excess of \$1.7 million per year. The estimated employment of thirty full and ten parttime semi-skilled jobs would generate no more than \$300,000 per year (the plan should be more specific as to the type and location of jobs), which leaves \$1.4 million in income largely unaccounted for.

Response: These figures were developed using a multiplier for the James River Basin. No multiplier was available for the Farmville area. The cost of developing multipliers for small watersheds is prohibitive. It is realized that the accuracy of the numbers is open to questions. However, they were developed using the best data available. The results were not used in the cost-benefit ratio and so do not cause a distortion in this vital area.

- (9) Comment: Consideration of the economic and social benefits should note that such P.L. projects; e.g. Buggs Island, often encourage subdivisions, recreational developments and other non-productive intensified land use. The plan should address the possible impacts the project could have on second-home, lake-front development. All the proposed structures with the exception of 1E are subject to intensified development. The loss of valuable forest and farmland due to resort-suburban development would not significantly increase the local tax base, but it would raise demands for public services.

Response: Prince Edward County will operate site 12 as a water supply reservoir. The Virginia Commission of Game and Inland Fisheries will operate site 1E as a fish and wildlife reservoir. Any home building adjacent to these reservoirs will be under the control of these governmental entities. The single purpose flood prevention structures will be privately controlled. The sponsors have agreed with the Service to operate all structures during their economic life in their planned purpose. We do not foresee any second-home, lake-front developments, although the plan does not strictly forbid it. The Service does not concur that recreational developments per se are a non-productive land use. Recreation and recreational developments appear to be thriving industries.

- (10) Comment: As to the engineering design, the project lakes will be shallow at drawdown. Sites 2-7 would have an average depth of five feet at drawdown and 1E and 12 ten foot average.

Response: The permanent lakes of the single-purpose sites (2 thru 7) vary from 10.4' to 17.4' in maximum depth, with average depths ranging from 5.0' to 5.8'. The permanent lake depths for the multiple-purpose sites are 42.0' maximum (15.8' average) and 33.2' maximum

(15.2' average) for sites 1E and 12, respectively. The depth of maximum drawdown for site 12 will be 11.0' maximum (5.8' average). These values are considered typical for this type of structure in the Piedmont section of Virginia.

- (11) Comment: A major point which should be expanded upon is the progress the plan has already achieved while still only in draft form. Site acquisition has proceeded to the point where acquisition of site 12 is 70 percent complete, and of the smaller structures, 2-7, all rights except Number 6 have been acquired.

Response: Landrights acquisition is the responsibility of the local sponsoring organizations. The sponsors are quite eager to begin installation of the measures in the draft plan. As a result, acquisition of landrights began soon after they selected the plan covered by the environmental impact statement.

- (12) Comment: Information describing methods of data collection and processing should be included in the DEIS, as elaboration of the determination of costs, discounting procedures, and where and how data was collected along with the sources used.

Response: This comment was answered in direct consultation with the State Water Control Board. All handbooks, technical notes, guidelines, memoranda, basic data, etc. used in development of the plan and EIS are available for inspection in the Watershed Planning Office, Richmond, Virginia. All data except that referenced in the narrative or footnotes were collected and analyzed by the Soil Conservation Service.

Virginia Soil and Water Conservation Commission

- (1) Comment: The combined Plan and Environmental Impact Statement for Bush River Watershed has been reviewed as requested in your letter dated November 12, 1975. Tremendous support for this project was demonstrated at the public meeting held in Farmville on November 18. I support the broad scope of this project which will provide the citizens of Prince Edward County with an adequate municipal water supply, flood prevention and an outstanding recreational facility. We have no comments to offer on either the draft Plan or the Environmental Impact Statement.

Response: We appreciate your review and comment, and wish to thank you for your continued interest and support.

LIST OF APPENDIXES

- APPENDIX A - Comparison of Benefits and Costs for Structural Measures
- APPENDIX B - Project Map
- APPENDIX C - Letters of Comment Received on the Draft Environmental Statement (to be included in the final environmental statement)
- APPENDIX D - Typical Land Treatment Practices
- APPENDIX E - List of Biota
- APPENDIX F - Glossary
- APPENDIX G - Bush River Water Quality Data
- APPENDIX H - 1. Briery Creek Fish and Wildlife Development
 2. Briery Creek Fish and Wildlife Development, Location of Facilities
- APPENDIX I - Water Supply Reservoir
- APPENDIX J - Topographic Map Index

APPROVED BY /s/ D. N. Grimwood DATE May 10, 1976
D. N. Grimwood
State Conservationist

APPENDIX A - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bush River Watershed, Virginia

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost	Benefit Cost Ratio
	Damage Reduction 2/	Intensive Land Use (Agr.)	Changed Land Use (Agr.)	Fish and Wildlife and Recreation	Municipal Water Supply	Local Secondary	Total		
All Structural Measures	155,500	58,380	52,250	281,100	138,970	63,350	749,550	404,670	1.9:1.0
Project Administration	xxx	xxx	xxx	xxx	xxx	xxx	xxx	29,480	xxx
GRAND TOTAL	155,500	58,380	52,250	281,100	138,970	63,350	749,550	434,150	1.7:1.0

1/ Price Base 1975 - Agricultural values (1974) Current Normalized Prices; all other values current (1975) prices.

2/ In addition, it is estimated that land treatment measures will provide floodwater and sediment damage reduction benefits of \$47,210 annually.

3/ Includes \$37,100 incidental recreation benefits to structure number 12.

Date: April 1976

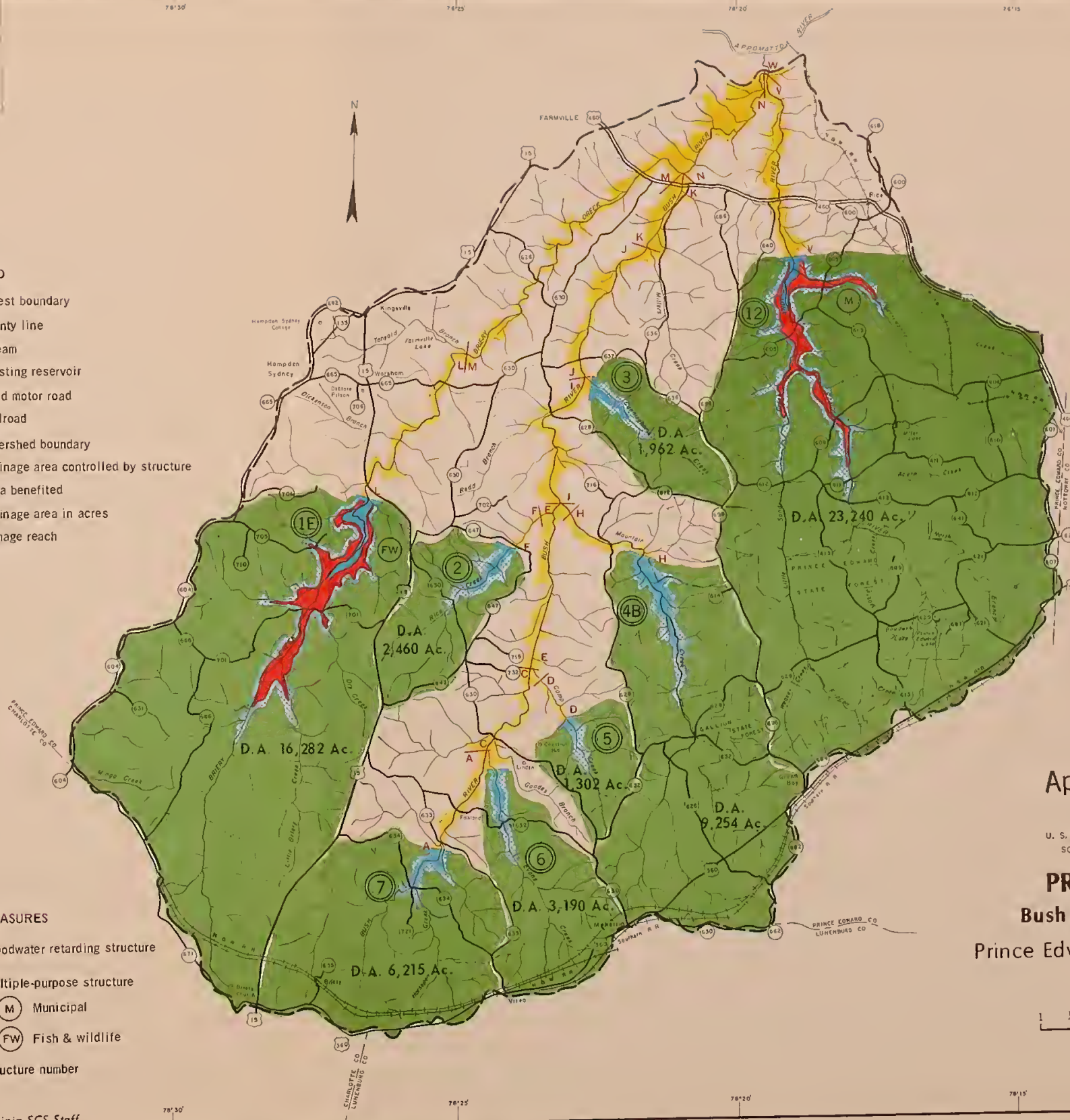


LEGEND

- Forest boundary
- County line
- Stream
- Existing reservoir
- Good motor road
- Railroad
- Watershed boundary
- Drainage area controlled by structure
- Area benefited
- D. A. 9,254 Ac. Drainage area in acres
- L | M Damage reach

PROJECT MEASURES

- Floodwater retarding structure
- Multiple-purpose structure
- (M) Municipal
- (FW) Fish & wildlife
- (2) Structure number



Appendix B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP Bush River Watershed Prince Edward County, Virginia

SEPTEMBER 1975

1 1/2 0 1 2 Miles



C-1

Letters of Comment Received on the Draft Environmental Impact Statement



20 NOV 1975

Honorable Robert W. Long
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Mr. Long:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Virginia State Conservationist of the Soil Conservation Service, by letter of 12 November 1975, requested the views of the Secretary of the Army on the watershed plan for Bush River Watershed, Virginia.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

The Virginia State Conservationist should be informed that regulatory permits will be required for work that affects navigable waters and requests for such permits should be made to the Norfolk District Office of the Corps of Engineers at the earliest possible date.

Sincerely,

Charles R. Ford
Deputy Assistant Secretary of the Army
(Civil Works)

bc:

D. N. Grimwood, SCS, Richmond, Virginia



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. Coast Guard
400 Seventh Street S.W.
Washington, D. C. 20590

21 JAN 1976

Mr. D.N. Grimwood
State Conservationist
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia

Dear Mr. Grimwood:

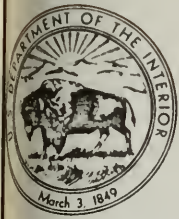
This is in response to your letter of 12 November 1975 addressed to the Commandant, U.S. Coast Guard concerning a draft environmental statement for the Bush River Watershed, Prince Edward County, Virginia.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

D. J. RILEY
Captain, U. S. Coast Guard
Acting Chief, Office of Marine
Environment and Systems



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-75/1100

JAN 17 1976

Dear Mr. Grimwood:

Thank you for the letter of November 12, 1975, requesting our views and comments on the work plan and draft environmental statement for Bush River Watershed, Prince Edward County, Virginia. Our review indicates that the proposal adequately describes impacts on outdoor recreation and contains a reasonable assessment of plant and animal resources. However, it does not address certain effects that the proposed project will have on fish and wildlife, and cultural resources. Specific comments by section are provided below.

Watershed Work Plan

We are pleased to note that the plan does not include any of the stream alteration features which were previously under consideration.

In accordance with Section 12 of the Watershed Protection and Flood Prevention Act, we strongly recommend your consideration of the following:

1. Access, in fee or easement, be provided at each impoundment; and
2. Standing timber be left in shallow water areas (depth less than or equal to six feet) in all proposed reservoirs.

Draft Environmental Statement

Planned Project

Fresh water fishing demands by regions for the State of Virginia are shown in Volume II of the "Virginia Outdoors Plan, 1970." The plan indicates that fishing demand in this region will more than triple by the year 2020. Unfortunately, according to the draft statement, page II-15, the general public will be prohibited from using sites 2, 3, 4B, 5, 6, and 7. Furthermore, public access to the available fishing sites on 1E and 12 will be limited to road crossings. Additional information should



therefore be provided in the final statement as to why the project sponsors decided not to allow more public access. Monetary expenditures necessary to provide the bare essentials at each site and what effect this would have on the benefit cost ratio should also be discussed both here and in the work plan.

It is stated on page II-16, paragraph 3, that a bottom release will be installed in these structures. The effects of cold deoxygenated waters released from a potential hypolimnion should be discussed with respect to tailwater fishery resources. The possibility of lake stratification should likewise be discussed.

Woodland improvement mentioned in this section includes removal of non-merchantable or unwanted trees, shrubs, or vines. This practice can be very detrimental to the well being of forest dwelling wildlife species. Many times non-merchantable trees contain cavities which provide nests and shelter for a number of species, including squirrels, raccoons, screech owls, and woodpeckers. Removal of vines and shrubs having no commercial timber value will substantially reduce the carrying capacity of such habitats for deer and turkey, which depend on under-story species for food. These impacts should be addressed in the environmental impact section.

Environmental Setting

An evaluation of cultural resources is presently being accomplished in coordination with the Virginia Historic Preservation Officer. This official's approval of the evaluation should be documented. The final statement should include a complete discussion of potential project impacts on cultural resources in relation to alternatives considered.

It is noted that "the State Archeologist is conducting the field examination and the result will be available before preparation of the final environmental statement" (page II-48). Professional archeological supervision should also be exercised as work progresses. The contract with the excavator should include a stop-work clause to provide for archeological salvage of any evidence encountered.

The Advisory Council on Historic Preservation should also be consulted if the undertaking will have an effect upon properties on or eligible for inclusion on the National Register of Historic Places.

Page II-48 notes that Linden "...a late 18th Century frame house located off State Route 630... has been torn down and removed...." If this removal was accomplished in relation to this project, an assessment should be made thereof with the approval of the Virginia Historic Preservation Officer. The historic value of the property should be assessed in relation to the possibilities of archeological salvage.

Ground water is discussed on pages II-37 and II-59. We suggest in addition that the more prolonged effects on ground-water levels in the vicinity of the multiple-use structures and the temporary effects in the vicinity of flood retardation structures should be considered, as should the effects of land treatment on recharge to ground water.

Environmental Impact

On page II-68, a reference is made to specific reductions in sediments entering the navigable channels of the James River. However, no data are presented to show the expected increases in sedimentation due to construction and increased cultivation on the flood plain. These increases in sedimentation should be discussed with respect to their effects on fish and wildlife resources. An adequate discussion of these effects was noted on pages II-57 and II-58 (Water and Related Land Resource Problems). This discussion should also be included in the environmental impact section.

It is stated on page II-69 that the two impoundments open to the public for fishing will result in 159,100 user-days annually. It is unclear whether this figure signifies recreation user-days, which would include picnicking, camping, boating, and other uses, or whether it indicates fisherman user-days. This point should be clarified in the final environmental statement.

On page II-69, paragraph 3, it is stated that wildlife habitat will be protected from future development in the flood pool. Does this mean that there will be no farming or timber harvesting in the flood pool? The expected uses of these areas should be addressed, and the statement concerning the protection of wildlife habitat should be substantiated.

The standing timber left in the flood pool and shallow areas of the permanent reservoirs will benefit the fishery and riparian wildlife, especially wood ducks. Was this considered as a

mitigating feature of the proposed project? The second paragraph on page II-70 states that 43 acres above the flood pool will be cleared. An explanation of the reasons for this clearing should be given.

Alternatives

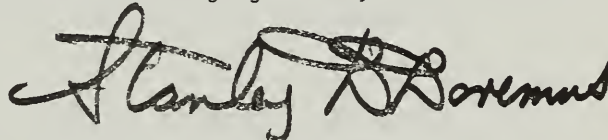
This section should discuss the possibilities of implementing dry-bed reservoirs as an alternative to single-purpose flood water retarding reservoirs. The effects of dry-bed reservoirs on fish and wildlife resources should be discussed. The section should also discuss the alternative of providing public access to all impoundments.

Short-Term vs. Long-Term Use of Resources

This section should include a discussion of any changes in wildlife habitat along the flood plain which are expected to occur as a result of the project.

We hope these comments and suggestions will be of assistance to you.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Stanley D. Foreman". The signature is fluid and cursive, with a large initial "S" and "F".

Deputy Assistant, Secretary of the Interior

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
Department of Agriculture
P. O. Box 10026
Richmond, Virginia 23240



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

January 29, 1976

Mr. D. N. Grimwood
Soil Conservation Service
P.O. Box 10026
Richmond, Va. 23240

Dear Mr. Grimwood:

We have completed our review of the Draft Plan and Draft Environmental Impact Statement for the Bush River Watershed in Prince Edward County, Virginia. On the basis of our review we have placed the project in EPA reporting category "LO-2". I have enclosed a sheet explaining this rating system. The classification and date of EPA's comments will be published in accordance with our responsibility to inform the public of our views on proposed actions under Section 309 of the Clean Air Act. Our specific comments resulting from the review follow.

On page I-20, \$1.00/visit is subtracted from the gross benefits on Structure 12. The same procedure is not utilized for Site 1E. An explanation should be furnished for not subtracting a like amount from the gross benefits on Site 1E.

One concern is the proposal for water supply storage. On page II-58, reference is made to Buffalo Creek in supplying the drinking water to Farmville. Plant capacity is 1.1 MGD with consumption from 0.6 to 0.75 MGD. A proposed project alternative may call for expansion of existing facilities at Buffalo Creek to meet future water demands. The raw water may be taken from Buffalo Creek or the Appamatox River.

Related to the above problem is the apparently inflated future water demands given on page II-60. In the period from 1975-2020, the total water needs are projected to double. But in that same time span, the population is expected to increase about 10% and the water users may increase 20% as indicated on pages II-39 and II-72, respectively. Justification of these projected water needs should be presented.

The current reference for classification of Virginia waters is the 1974 not 1970 publication as cited on page II-38.

On page II-60, it is related that the nearby state park facilities are "filled to capacity." Does this refer to all activities or camping facilities only?

Reservoir location #12 is proposed as a water supply system. Benefits derived from the project include future industrial growth due to increased availability of water. We recommend that any site acquisition study, for industrial operations, consider the maintenance of water quality and quantity downstream of the site. Water impacts may be severe during low flow periods when a significant percentage of stream flow is diverted through industrial systems, and discharged as polluted effluent.

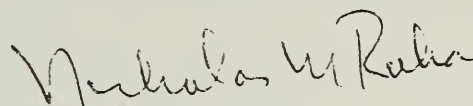
A discussion of land value is found on page II-52. In particular, the statement claims that one acre of floodplain is worth two acres of upland. Are there any data to support this claim? If so, it should be referenced in the EIS.

What will be the impact of the 520 acres of mudflats on public health and water quality (page II-69)?

We recommend that all flood control structures have dry pools rather than small pools that may become a health or water quality nuisance.

Please let us know if we can be of assistance in solving problems that may arise in preparation of the Final EIS.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Nicholas M. Ruha". The signature is fluid and cursive, with the first name being the most prominent.

Nicholas M. Ruha
Chief

EIS and Wetlands Review Section



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III

6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

10-32-78

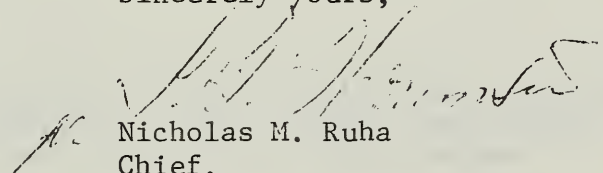
Mr. D. N. Grimwood
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

We have reviewed your responses to our comments on the Draft Environmental Impact Statement for the Bush River watershed project, Prince Edward County, Virginia. We find that our concerns are adequately addressed, and we concur with the adequacy of the Impact Statement.

We trust that the continued coordination and cooperation between both our agencies will continue. If we can be of further assistance, especially in Pre-EIS liason, please do not hesitate to contact us.

Sincerely yours,


Nicholas M. Ruha
Chief,
EIS and Wetlands Review



COMMONWEALTH of VIRGINIA

Council on the Environment

GERALD P. McCARTHY
ADMINISTRATOR

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219

January 28, 1976

Mr. David N. Grimwood
State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 10026
Richmond, Virginia 23240

Subject: Bush River Watershed, Prince Edward County, Virginia
Draft Plan and Draft Environmental Impact Statement

Dear Mr. Grimwood:

We have completed our review of the Plan and Draft Environmental Impact Statement for the subject Watershed. The following state agencies participated in this review:

Division of State Planning and Community Affairs
State Water Control Board
State Department of Health
Commission of Game and Inland Fisheries
Marine Resources Commission
State Air Pollution Control Board
Virginia Institute of Marine Science
Commission of Outdoor Recreation
Historic Landmarks Commission
Department of Agriculture and Commerce
State Corporation Commission
Department of Conservation and Economic Development
Virginia Port Authority
Department of Highways and Transportation

The response received from these agencies indicated in general that the project is compatible with their goals, objectives, programs and plans. A number of comments were received, however,

Mr. David N. Grimwood
January 28, 1976
Page Two

that I would like to bring to your attention for consideration as your plans progress. Of greatest significance among these comments are those submitted by the State Water Control Board, which are attached. The State Water Control Board has indicated that certain points discussed in the subject report should be expanded and/or clarified. For this purpose please contact:

Mr. J. L. Hamrick, Director
Environmental Affairs, Bureau of
Enforcement, State Water Control Board
2111 North Hamilton Street
P.O. Box 11143
Richmond, Virginia 23230
786-1411

It is hoped that satisfactory resolution of these issues can be accomplished through your direct discussions with the staff of the State Water Control Board. If this cannot be accomplished, the Council on the Environment would be glad to make the necessary arrangements for a conference for a detailed examination of the plan and for resolution of the State Water Control Board staff questions and concerns.

Additionally, the State Department of Health has reported their endorsement of the project subject to the condition that water withdrawal structures at Site 12 contain multiple outlets at various depths to meet the Waterworks Regulations. That department also would like to review plans for the outlet structure for any proposed water treatment plant prior to construction. To discuss these points please contact:

Mr. Oscar H. Adams, Director
Division of Engineering
State Department of Health
Madison Building
Richmond, Virginia 23219
786-6277

The State Air Pollution Control Board has notified us that, while the project should have no permanent impact on air quality, state regulations governing open burning and fugitive dust must be complied with during the construction phase of the project. For further explanation of these regulations, please contact:

Mr. David N. Grimwood
January 28, 1976
Page Three

Mr. John M. Daniel, Jr.
Assistant Executive Director, Enforcement
State Air Pollution Control Board
1106 Ninth Street Office Building
Richmond, Virginia 23219
786-3248

Finally, the State Department of Highways and Transportation has offered the following comments:

Prince Edward County will be involved in the process of closing roads that are affected by the permanent reservoir and also those affected on the temporary basis. Four secondary crossings and two forest trails will be affected by the permanent pools and four other secondary crossings will be affected by the flood pools.

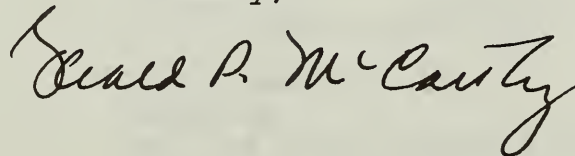
The responsibility of Prince Edward County to close the roads in flood pool areas during inundation should be emphasized, as local residents may assume that the Department has that responsibility.

The document indicates that some planning relative to the impact on secondary roads by the project has been coordinated with some sections within the Department. However, in order to ensure that all appropriate Divisions be apprised of the subject project at the various stages of implementation, it would be advisable to channel all future information through the Department's Resident Engineer at the Dillwyn Residency.

It is obvious that some upgrading of the secondary roads in the project area will be necessary, particularly those serving the proposed fishing and boating site. Right of way for these facilities that will need to be upgraded should be provided in the initial stages, and the design of these roadways should meet the Virginia Department of Highways and Transportation standards.

Thank you for the opportunity to review this document. Please do not hesitate to get in touch with me if the Council on the Environment can be of any assistance in the development of your plans.

Sincerely,



GPM:dls

Attachment

cc: Honorable Earl J. Shiflet, Secretary of Commerce and Resources
Mr. J. L. Hamrick, State Water Control Board
Mr. Oscar H. Adams, State Department of Health
Mr. John M. Daniel, Jr., State Air Pollution Control Board



COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD

2111 Hamilton Street

Eugene T. Jensen
Executive Secretary
Post Office Box 11143
Richmond, Virginia 23230
(804)786-1411

IN REPLY, 3
REFER TO: _____

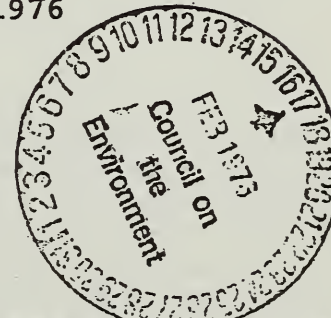
February 11, 1976

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Ms. Susan T. Wilburn
Environmental Impact Statement
Coordinator
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219



Re: SCS Watershed Plans and Draft
Environmental Impact Statements
for the Great Creek and Bush
River Watersheds.

Dear Ms. Wilburn:

On February 5 and 10, the staff held discussions with the Soil Conservation Service in an attempt to resolve various State Water Control Board questions concerning the above referenced reports. As a consequence of said discussions, several of the SWCB questions and concerns were satisfied; for this reason, the staff believes certain deletions and/or modifications of comments are in order. In lieu of the comment lists submitted on November 24, 1975 and January 12, 1976 for the Great Creek and Bush River Watershed Plans, respectively, please accept the two revised comment lists attached hereto.

Thank you for your cooperation. Please feel free to contact us should you have any questions.

Very truly yours,

J. L. Hamrick, Jr.
Director
Div. of Environmental Affairs
Bureau of Enforcement

JCH/dd

cc: Mr. David N. Grimwood
Soil Conservation Service

REVISED
COMMENTS SUBMITTED BY
STATE WATER CONTROL BOARD
FOR
BUSH RIVER WATERSHED, PRINCE EDWARD COUNTY, VIRGINIA
DRAFT PLAN AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

1. As indicated in the subject report (Section II, page 21), proposed Reservoir 12 will thermally stratify with the "hypolimnion becoming anoxic during the warm, lowflow, summer months." The report also states that "a 12 inch slide gate located five feet above the base of the riser in addition to the water supply gates will serve the function of flow management (Section II, page 21)."

There is "no information provided which indicates the modus operandi of the aforementioned gates for regulation of the dissolved oxygen and temperature of the releases. If water is withdrawn exclusively from the hypolimnion, the low D.O. content of the releases could have possible detrimental impacts on downstream biota of the Sandy River.

To assure compliance with Virginia Water Quality Standards, a program for water quality regulation and monitoring of the releases should be developed for Reservoir 12.

The problem of stratification should be addressed for each of the other seven proposed reservoirs, particularly, for proposed Reservoir 1E.

2. The subject document indicates that one of the major functions of the proposed reservoirs is storage for sediment entering the Bush River Watershed from various land disturbing activities. Associated with the influx of sediment to the reservoirs will be nutrients from non-point sources, i.e. fertilizers from farmlands and nitrogenous wastes from pastureland. (An additional source of nutrients will be fertilizers applied in establishment of vegetative land treatment measures in the watershed above the reservoir.)

In view of the continued importance of farming and grazing activities in the Bush River Watershed, nutrient enrichment of proposed reservoirs seems likely. Coupled with sedimentation, this nutrient enrichment will accelerate the eutrophication of the reservoirs, eventually, causing the appearance of algal blooms and a reduction of dissolved oxygen concentrations.

Eutrophication would severely impair the viability of Reservoir 12 to function as public water supplies and would negate the attractiveness of reservoirs for public recreation. In addition, the releases from the dams would have lower dissolved oxygen concentrations, thus, affecting downstream water quality.

3. To minimize sedimentation, construction of the dams and reservoirs should be scheduled for the dry months of the year. Furthermore, cofferdams should be placed downstream from each of the 8 construction sites, to minimize the effect of earth disturbing activities on downstream turbidity.
4. The project was submitted by the sponsors in 1967, but neither the draft plan nor the DEIS mentions or evaluates projects that have been proposed or approved since that time. Some recent projects which could have a significant effect upon the plan are the Farmville Water Treatment Plant currently under construction, and the proposed Nottaway Falls Recreation Area.
5. Sediment control is a primary goal of the project. An important consideration in attaining this goal is the relationship between sediment transport and erosion. Because the rate of erosion is inversely proportional to the sediment load, an environmentally favorable balance must exist between the two. Such a balance should achieve minimum stream scouring and erosion at a minimum sediment load. The total sediment damage to the James River Basin and the project's ability to reduce sediment damage appear to be overstated. The entire James River Basin comprises 6,442,000 acres and Bush River comprises 98,700 acres or 1.5 percent of the total. The damage which the basin, by project estimate contributes amounts to seven percent of the total damage to the entire basin, estimated at \$3 million by the USDA. Broken down by acre, each acre

of the James Basin contributes \$.47/year of sediment damage to the total basin, but each acre on the project basin contributes \$.86/year of damage. The basin's flood plain slope averages from one to three percent, and the uplands average from six to fifteen percent. If the estimated \$114,540 sediment damage reduction is correct, it would mean that the project would reduce sediment damage in the James Basin by almost four percent per/year, a figure which we believe is too large. We also question the sediment damages (about \$197,240 annually) estimated to occur in Lake Chesdin and navigable channels of the Appomattox and James Rivers as consequence of the influx of sediment from the Bush River Watershed. Was the estimate of sediment reaching the navigable channels based on actual field data?

6. The plan projects a domestic water supply demand of 3.7 MGD by 2020. This figure appears to be overstated when compared to the PDC's M/R Plan which projects a demand of 2.1 MGD in 2000. The subject report projects 2.7 MGD for the same year. If the PDC's figures are projected at a constant rate for 20 years to 2020, the domestic water demand is 2.7 - 2.9 MGD to 3.7 MGD, a difference large enough to warrant re-evaluation.

The total water supply demand is estimated at 11.06 MGD by 2020; that could be supplied by a reservoir with a storage capacity of 10,000 acre/feet. Of this demand, only 3.7 MGD is consumed in domestic use; the remainder is projected for agricultural and industrial use, a use which normally does not require treated water.

An alternative which should be evaluated is the Farmville Plant, currently under construction with a raw water intake on the Appomattox River. The plant will have an initial capacity of 3 MGD with the capability to expand upward to 12 MGD.

Based on the 1-day, 30-year low flow at Farmville, the system may withdraw about 5.4 MGD of which about 85 percent is returned. By using two intakes, one at Farmville and another downstream, the region could expand its water withdrawals to approximately 9.9 MGD and remain within the limits of the 1-day, 30-year low flow.

Page 1-19 contains the statement: "Benefits to municipal and industrial water storage amount to \$138,970 annually based on alternative development costs provided by the consultants." This statement would be more understandable if staff knew what alternative sources are being used in comparison.

Comments from the State Water Control Board
Re: Bush River Watershed, Draft Plan and DEIS
Page Four

7. The distribution of benefits seems to be weighted in favor of private landowners. Access to sites 2-7 will be largely restricted to adjacent property landowners.
8. The plan states that implementation will cause a rise in family income of \$1,500 per year. How was this figure determined? No supporting data is provided. Based on the PDC's 1970 estimates of 3.1 persons per household, the project would have to generate increases in income in excess of \$1.7 million per year. The estimated employment of thirty full and ten parttime semi-skilled jobs would generate no more than \$300,000 per year (the plan should be more specific as to the type and location of jobs), which leaves \$1.4 million in income largely unaccounted for.
9. Consideration of the economic and social benefits should note that such P.L. projects; e.g. Buggs Island, often encourage subdivisions, recreational developments and other non-productive intensified land use. The plan should address the possible impacts the project could have on second-home, lake-front development. All the proposed structures with the exception of IE are subject of intensified development. The loss of valuable forest and farmland due to resort-suburban development would not significantly increase the local tax base, but it would raise demands for public services.
10. As to the engineering design, the project lakes will be shallow at drawdown. Sites 2-7 would have an average depth of five feet at drawdown and IE and 12 and ten foot average.
11. A major point which should be expanded upon is the progress the plan has already achieved while still only in draft form. Site acquisition has proceeded to the point where acquisition of site 12 is 70 percent complete, and of the smaller structures, 2-7, all rights except Number 6 have been acquired.
12. Information describing methods of data collection and processing should be included in the DEIS, as elaboration of the determination of costs, discounting procedures, and where and how data was collected along with the sources used.

R. DuVal Dickinson, *Chairman*
Fredericksburg
Henry C. Green, *Vice Chairman*
Markham
S. Mason Carbaugh, *Richmond*
P. W. Davis, *Davis Wharf*
Donald D. Gray, *Castlewood*
David N. Grimwood, *Richmond*
W. Rogers Meador, *Goochland*
W. E. Skelton, *Blacksburg*
M. M. Sutherland, *Richmond*
Elmer M. Venskoske, *Winchester*
R. E. Wilkinson, *Kenbridge*
Coyt T. Wilson, *Blacksburg*



Joseph B. Willson, Jr.
Director

Donald L. Wells
Deputy Director

COMMONWEALTH of VIRGINIA

VIRGINIA SOIL AND WATER CONSERVATION COMMISSION

(804) 786-2064

830 EAST MAIN STREET, SUITE 800
RICHMOND, VIRGINIA 23219

December 5, 1975

Mr. David N. Grimwood, State Conservationist
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia 23240

Dear Dave:

The combined Plan and Environmental Impact Statement for Bush River Watershed has been reviewed as requested in your letter dated November 12, 1975. Tremendous support for this project was demonstrated at the public meeting held in Farmville on November 18. I support the broad scope of this project which will provide the citizens of Prince Edward County with an adequate municipal water supply, flood protection and an outstanding recreational facility. We have no comments to offer on either the draft Plan or the Environmental Impact Statement.

Sincerely,

A handwritten signature in dark ink, appearing to read "Joe", written over the printed name.

Joseph B. Willson, Jr.
Director

JBW:ba

APPENDIX D

Typical Land Treatment Practices used in providing conservation treatment of land.

1. Access Road
2. Agricultural Waste Management System
3. Conservation Cropping System
4. Contour Farming
5. Critical Area Planting
6. Debris Basin
7. Diversion
8. Field Border
9. Grassed Waterway or Outlet
10. Gravel Outlet Structure
11. Heavy Use Area Protection
12. Forest Grazing Control
13. Level Spreader
14. Livestock Exclusion
15. Minimum Tillage
16. Pasture and Hayland Management
17. Recreation Area Improvement
18. Skid Trail and Logging Road Erosion Control
19. Storm Drain Outlet Protection
20. Straw Bale Barrier
21. Tree Planting
22. Wildlife Upland Habitat Management
23. Woodland Improved Harvesting
24. Timber Stand Improvement

Definitions and Purposes

1. Access Road ^{1/}: road constructed as part of a conservation plan to provide needed access. Provides access to farms, ranches, fields, conservation systems, structures, and recreation areas; provides a route for travel, for moving equipment and supplies; and provides access for proper operation and management of conservation enterprises.
2. Agricultural Waste Management System ^{1/}: a planned agricultural waste management system to contain and manage liquid and solid wastes including runoff from concentrated waste areas, with ultimate disposal in a manner which does not degrade air, soil, or water resources, and protects public health and safety. This practice includes systems for safe disposal of livestock wastes, municipal waste treatment plant effluents and sludges, and agricultural processing wastes through use of soil and plants.
3. Conservation Cropping System ^{2/}: growing crops in combination with needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops. Designed to improve or maintain good physical

- condition of the soil; protect the soil during periods when erosion usually occurs; help control weeds, insects, and diseases; and meet the needs and desires of farmers for economic returns.
4. Contour Farming^{2/}: farming sloping cultivated land in such a way that plowing, preparing land, planting, and cultivating are done on the contour (includes following established grades of terraces, diversions, or contour strips) in order to reduce erosion and control water.
 5. Critical Area Planting^{2/}: planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas to stabilize the soil; reduce damage from sediment and runoff to downstream areas; improve wildlife habitat; and enhance natural beauty.
 6. Debris Basin^{1/}: barrier or dam constructed across a waterway or at other suitable locations to form a silt or sediment basin that will preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams; prevent undesirable deposition on bottomlands and developed areas; trap sediment originating from construction sites; and reduce or abate pollution by providing basins for deposition and storage of silt, sand, gravel, stone, agricultural wastes, and other detritus.
 7. Diversion^{1/}: channel with a supporting ridge on the lower side constructed across the slope for the purpose of diverting water from areas where it is in excess to sites where it can be used or disposed of safely.
 8. Field Border^{2/}: border or strip of perennial vegetation established at the edge of a field by planting, or by converting it from trees to herbaceous vegetation or shrubs, in order to control erosion; protect edges of fields that are used as "turn rows" or travel lanes for farm machinery; reduce competition from adjacent woodland; provide wildlife food and cover; or improve the landscape.
 9. Grassed Waterway or Outlet^{1/}: natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure; they provide for the disposal of excess surface water from terraces, diversions, or from natural conditions without damage by erosion or flooding.
 10. Gravel Outlet Structure^{4/}: an auxiliary structure installed in combination with and as a part of a diversion, interceptor or perimeter dike, or other structures designed to temporarily detain sediment-laden storm water. The gravel outlet provides a means of draining off and filtering the storm water while retaining the sediment behind the structure.

11. Heavy Use Area Protection^{2/}: protecting heavily used areas by establishing vegetative cover, by surfacing with suitable materials, or by installing needed structures. This practice is used to stabilize an urban, recreation or essential facility area subjected to sustained heavy use by people, animals or vehicles.
12. Forest Grazing Control: excluding all livestock permanently from forest land by means of fencing or a land use change adjoining the forest land. This will prevent impairment of hydrologic conditions by reducing soil compaction and erosion; damage to tree roots, seedlings, and other ground cover; and the loss of litter and humus.
13. Level Spreader^{4/}: a temporary outlet constructed at zero grade across the slope whereby concentrated runoff may be discharged at non-erosive velocities onto undisturbed areas stabilized by existing vegetation. The spreader is designed to convert a concentrated flow of storm runoff into sheet flow and to outlet it without causing erosion.
14. Livestock Exclusion^{2/}: excluding livestock from an area where grazing is not wanted; protect, maintain, or improve the quantity and quality of the plant and animal resources; to maintain enough cover to protect the soil; to maintain moisture resources; and to increase natural beauty.
15. Minimum Tillage^{2/}: limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. This practice retards deterioration of soil structure; reduces soil compaction and formation of tillage pans; and improves soil aeration, permeability, and tilth.
16. Pasture and Hayland Management^{2/}: proper treatment and use of pastureland or hayland for the purpose of prolonging life of desirable forage species; maintaining or improving the quality and quantity of forage; and protecting the soil and reducing water loss.
17. Recreation Area Improvement^{2/}: establishing grasses, legumes, vines, shrubs, trees, or other plants or selectively reducing stand density and trimming woody plants to improve the attractiveness and usefulness of an area for recreation and to protect the soil and plant resources.
18. Skid Trail and Logging Road Erosion Control^{3/}: to reduce runoff, erosion, and sedimentation by diverting water from skid trails and logging roads. Simple water bars (ditches with pole or earthen diversions) spaced at specified intervals are the usual means used to divert this type of surface runoff.
19. Storm Drain Outlet Protection^{4/}: paved and/or riprapped channel sections, placed below storm drain outlets, to reduce velocity of flow before it enters receiving channels.

20. Straw (or Hay) Bale Barrier^{4/}: a temporary barrier installed across, or at the toe of, a slope to intercept and detain sediment from areas one-half acre or smaller, where only sheet erosion may be a problem.
21. Tree Planting^{2/}: planting tree seedlings or cuttings in order to establish or reinforce a stand of trees to conserve soil and moisture, beautify an area, protect a watershed, or produce wood crops.
22. Wildlife Upland Habitat Management^{2/}: retaining, creating, or managing wildlife habitat (other than wetland) to keep, make, or improve habitat for desired kinds of wildlife.
23. Woodland Improved Harvesting^{2/}: systematically removing some of the merchantable trees from an immature stand or all the trees from a designated part of a woodland to improve the conditions for forest growth and/or to harvest trees in a manner that encourages the regeneration and normal development of a new stand.
24. Timber Stand Improvement^{3/}: These cultural operations are aimed at improving hydrologic conditions in woodland by manipulation of stand composition to create favorable conditions for the maximum production and protection of litter, humus, and forest cover. They include supplemental plantings, weedings, thinnings, improvement, release and harvest cuttings.

- 1/ Engineering Practice Standards and Specifications for Soil and Water Conservation in Virginia, Soil Conservation Service, United States Department of Agriculture, September 1973.
- 2/ National Handbook of Conservation Practices, United States Department of Agriculture, Soil Conservation Service, July 1971.
- 3/ Forest Service.
- 4/ Virginia Erosion and Sediment Control Handbook, Virginia Soil and Water Conservation Commission, April 1974.

APPENDIX E - LIST OF BIOTA

PLANTS COMMON TO BUSH RIVER WATERSHED

CROPS

<u>Common Name</u>	<u>Scientific Name</u>
Corn	<i>Zea mays</i>
Oats	<i>Avena sativa</i>
Rye	<i>Secale cereale</i>
Wheat	<i>Triticum aestivum</i>
Ky-31 fescue	<i>Festuca arundinacea</i>
Orchardgrass	<i>Dactylis glomerata</i>
Redtop	<i>Agrostis alba</i>
Italian ryegrass	<i>Lolium multiflorum</i>
Sudangrass	<i>Sorghum sudanensis</i>
Ladino clover	<i>Trifolium repens latum</i>
Korean lespedeza	<i>Lespedeza stipulaceae</i>
Sericea lespedeza	<i>Lespedeza cuneata</i>
Soybeans	<i>Glycine max</i>
White clover	<i>Trifolium repens</i>
Sweet clover	<i>Melilotus spp.</i>
Tobacco, fire cured	<i>Nicotiana spp.</i>
Tobacco, dark fired	<i>Nicotiana spp.</i>
Apples	<i>Malus spp.</i>
Peaches	<i>Prunus spp.</i>
Barley	<i>Hordeum spp.</i>
Alfalfa	<i>Medicago spp.</i>
Timothy	<i>Phleum pratense</i>
Sorghum	<i>Sorghum spp.</i>

FORBS

Pigweed	<i>Amaranthus spp.</i>
Hemp dogbane	<i>Apocynum cannabinum</i>
Milkweed	<i>Asclepias spp.</i>
Chickweed	<i>Stellaria spp.</i>
Lambsquarter	<i>Chenopodium album</i>
Yarrow	<i>Achillea millefolium</i>
Ragweed	<i>Ambrosia artemisiifolia</i>
Giant ragweed	<i>Ambrosia trifida</i>
Whiteheath aster	<i>Aster pilosus</i>
Bull thistle	<i>Cirsium vulgare</i>
Annual fleabane	<i>Erigeron annuus</i>
Horseweed	<i>Erigeron canadensis</i>
Cudweed	<i>Gnaphalium spp.</i>
Wild lettuce	<i>Lactuca scariola</i>
Groundsel	<i>Senecio spp.</i>
Goldenrod	<i>Solidago spp.</i>
Dandelion	<i>Taraxacum officinale</i>
Cocklebur	<i>Xanthium pennsylvanicum</i>

PLANTS COMMON TO BUSH RIVER WATERSHED (continued)

FORBS

<u>Common Name</u>	<u>Scientific Name</u>
Morning glory	<i>Ipomoea</i> spp.
Wild mustard	<i>Brassica kaber</i>
Pepperweed	<i>Lepidium virginicum</i>
Spurge	<i>Euphorbia</i> spp.
Dock	<i>Rumex</i> spp.
Pokeweed	<i>Phytolacca americana</i>
Plantain	<i>Plantago</i> spp.
Jimson weed	<i>Datura stramonium</i>
Wild carrot	<i>Dacus carota</i>
Henbit	<i>Lanium amplexicaule</i>
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>
Black-eyed susan	<i>Rudbeckia hirta</i>
Striped pipsissewa	<i>Chimaphila maculata</i>
Vetch	<i>Vicia</i> spp.
Clovers	<i>Trifolium</i> spp.
Beggarweed	<i>Desmodium</i> spp.

GRASSES

Broomsedge bluestem	<i>Andropogon virginicus</i>
Little bluestem	<i>Andropogon scoparius</i>
Indiangrass	<i>Sorghastrum nutans</i>
Bermudagrass	<i>Cynodon dactylon</i>
Crabgrass	<i>Digitaria sanguinalis</i>
Barneyard grass	<i>Echinochloa crusgalli</i>
Goosegrass	<i>Eleusine indica</i>
Foxtail	<i>Setaria</i> spp.
Johnsongrass	<i>Sorghum halepense</i>
Purpletop tridens	<i>Tridens flavus</i>
Cheatgrass	<i>Bromus tectorum</i>
Orchardgrass	<i>Dactylis glomerata</i>
Fescue	<i>Festuca</i> spp.
Eastern gamagrass	<i>Tripsacum dactyloides</i>

SHRUBS

Speckled alder	<i>Alnus rugosa</i>
Arrowwood	<i>Viburnum dentatum</i>
Blue berry	<i>Vaccinium</i> spp.
Chinquapin	<i>Castanea pumila</i>
Pawpaw	<i>Asimina triloba</i>
Mountain laurel	<i>Kalmia latifolia</i>
Mapleleaved viburnum	<i>Viburnum aceritolium</i>
Sweet pepperbush	<i>Clethra alnifolia</i>
Strawberry bush	<i>Euonymus americanus</i>
Dwarf sumac	<i>Rhus copallina</i>
Poison ivy	<i>Rhus radicans</i>

PLANTS COMMON TO BUSH RIVER WATERSHED (continued)

SHRUBS

<u>Common Name</u>	<u>Scientific Name</u>
Smooth sumac	<i>Rhus glabra</i>
Spicebush	<i>Lindera benzoin</i>
Witch hazel	<i>Hamamelia virginiana</i>
Wild rose	<i>Rosa</i> spp.

TREES

Ash	<i>Fraxinus</i> spp.
River birch	<i>Betula nigra</i>
Eastern red cedar	<i>Juniperus virginiana</i>
Wild cherry	<i>Prunus serotina</i>
Flowering dogwood	<i>Cornus florida</i>
Boxelder	<i>Acer negundo</i>
American elm	<i>Ulmus americana</i>
Winged elm	<i>Ulmus alata</i>
Blackgum	<i>Nyssa sylvatica</i>
Sweetgum	<i>Liquidambar styraciflua</i>
Hackberry	<i>Celtis occidentalis</i>
Bitternut hickory	<i>Carya cordiformis</i>
Mockernut hickory	<i>Carya tomentosa</i>
Pignut hickory	<i>Carya glabra</i>
American holly	<i>Ilex opaca</i>
Ironwood	<i>Carpinus caroliniana</i>
Black locust	<i>Robinia pseudocacia</i>
Red maple	<i>Acer rubrum</i>
Silver maple	<i>Acer saccharinum</i>
Black oak	<i>Quercus velutina</i>
Blackjack oak	<i>Quercus marilandica</i>
Chestnut oak	<i>Quercus montana</i>
Northern red oak	<i>Quercus rubra</i>
Post oak	<i>Quercus stellata</i>
Scarlet oak	<i>Quercus coccinea</i>
Southern red oak	<i>Quercus falcata</i>
Water oak	<i>Quercus nigra</i>
White oak	<i>Quercus alba</i>
Willow oak	<i>Quercus phellos</i>
Persimmon	<i>Diospyros virginiana</i>
Loblolly pine	<i>Pinus taeda</i>
Shortleaf pine	<i>Pinus echinata</i>
Virginia pine	<i>Pinus virginiana</i>
Yellow-poplar	<i>Liriodendron tulipifera</i>
Redbud	<i>Cercis canadensis</i>
Sassafras	<i>Sassafras albidum</i>
Serviceberry	<i>Amelanchier canadensis</i>
Sourwood	<i>Oxydendrum arboreum</i>
Sycamore	<i>Plantanus occidentais</i>
Black walnut	<i>Juglans nigra</i>
Black willow	<i>Salix nigra</i>

LIST OF FISHES COLLECTED IN BUSH RIVER WATERSHED ON
AUGUST 30-31, 1973 AND MARCH 8, 1974

<u>Common Name</u>	<u>Scientific Name</u>	<u>Sandy River</u>	<u>Briery Creek</u>	<u>Bush River</u>
American eel	<i>Anguilla rostrata</i>		x	x
Chain pickerel	<i>Esox niger</i>	x	x	x
Stoneroller	<i>Campostoma anomalum</i>			x
Carp	<i>Cyprinus carpio</i>			x
Silvery minnow	<i>Hybognathus nuchalis</i>	x		
Bluehead chub	<i>Nocomis leptcephalus</i>			x
Golden shiner	<i>Notemigonus crysoleucas</i>		x	
Comely shiner	<i>Notropis amoenus</i>		x	x
Satinfin shiner	<i>N. analostanus</i>			x
Rosefin shiner	<i>N. ardens</i>		x	
Bridle shiner	<i>N. bifrenatus</i>	x	x	x
Common shiner	<i>N. cornutus</i>		x	
Swallowtail shiner	<i>N. procer</i>		x	
Blacknose dace	<i>Rhinichthys atratulus</i>			x
Creek chub	<i>Semotilus atromaculatus</i>			x
Fallfish	<i>S. corporalis</i>	x	x	
White sucker	<i>Catostomus commersoni</i>	x	x	x
Creek chubsucker	<i>Erimyzon oblongus</i>		x	x
Northern hog sucker	<i>Hypentelium nigricans</i>		x	x
Yellow bullhead	<i>Ictalurus natalis</i>	x	x	x
Brown bullhead	<i>I. nebulosus</i>		x	x
Margined madtom	<i>Noturus insignis</i>		x	x
Pirate perch	<i>Aphredoderus sayanus</i>	x	x	x
Eastern mudminnow	<i>Umbra pygmaea</i>	x		x
Mosquitofish	<i>Gambusia affinis</i>			x
Flier	<i>Centrarchus macropterus</i>		x	x
Redbreast sunfish	<i>Lepomis auritus</i>			x
Pumpkinseed	<i>L. gibbosus</i>	x	x	x
Warmouth	<i>L. gulosus</i>	x	x	x
Bluegill	<i>L. macrochirus</i>	x	x	x
Smallmouth bass	<i>Micropterus dolomieu</i>		x	
Largemouth bass	<i>M. salmoides</i>	x	x	
Black crappie	<i>Pomoxis nigromaculatus</i>		x	x
Fantail darter	<i>Etheostoma flabellare</i>		x	
Johnny darter	<i>E. nigrum</i>	x	x	x
Glassy darter	<i>E. vitreum</i>		x	
Stripeback darter	<i>Percina notogramma</i>	x	x	x

MAMMAL SPECIES COMMONLY OBSERVED IN THE BUSH RIVER WATERSHED AREA

<u>Common Name</u>	<u>Scientific Name</u>
Whitetailed deer	<i>Odocoileus virginianus</i>
Virginia opossum	<i>Didelphis virginiana</i>
Raccoon	<i>Procyon lotor</i>
Red fox	<i>Vulpes fulva</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Woodchuck	<i>Marmota monax</i>
Gray squirrel	<i>Sciurus carolinensis</i>
Eastern chipmunk	<i>Tamias striatus</i>
Beaver	<i>Castor canadensis</i>
Muskrat	<i>Ondatra zibethica</i>
River otter	<i>Lutra canadensis</i>
Longtail weasel	<i>Mustela frenata</i>
Mink	<i>Mustela vison</i>
Striped skunk	<i>Mephitis mephitis</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Voies	<i>Microtus spp.</i>
Mice	<i>Peromyscus spp.</i>
Woodland jumping mouse	<i>Zapus hudsonicus</i>
Eastern mole	<i>Scalopus aquaticus</i>
Southeastern shrew	<i>Sorex longirostris</i>
Cinereus shrew	<i>Sorex cinereus</i>
Least shrew	<i>Cryptotis parva</i>
Shorttail shrew	<i>Blarina brevicauda</i>

Sources: Landowners, trappers, game law enforcement personnel, Soil Conservation Service district conservationist and biologist.

AMPHIBIANS AND REPTILES OBSERVED IN BUSH RIVER WATERSHED

<u>Common Name</u>	<u>Scientific Name</u>
Red-spotted newt	<i>Diemictylus viridescens</i>
American toad	<i>Bufo americanus</i>
Bullfrog	<i>Rana catesbeiana</i>
Green frog	<i>R. clamitans</i>
Leopard frog	<i>R. pipiens</i>
Spring peeper	<i>Hyla crucifer</i>
Northern water snake	<i>Natrix sipedon</i>
Northern black racers	<i>Coluber constrictor</i>
Coastal Plain milk snake	<i>Lampropeltis dolia</i>
Copperhead	<i>Agkistrodon contortrix</i>
Eastern box turtle	<i>Terrapene carolina</i>
Common snapping turtle	<i>Chelydra serpentina</i>

BIRD SPECIES COMMONLY OBSERVED IN THE BUSH RIVER WATERSHED AREA

<u>Common Name</u>	<u>Scientific Name</u>
Wild turkey	<i>Meleagris gallopavo</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Bobwhite quail	<i>Colinus virginianus</i>
Mourning dove	<i>Zenaidura macroura</i>
Rock dove	<i>Columba livia</i>
Mallard	<i>Anas platyrhynchos</i>
Black duck	<i>Anas rubripes</i>
American widgeon	<i>Mareca americana</i>
Wood duck	<i>Aix sponsa</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Marsh hawk	<i>Circus cyaneus</i>
Sparrow hawk	<i>Falco sparverius</i>
Great horned owl	<i>Bubo virginianus</i>
Screech owl	<i>Otus asio</i>
Turkey vulture	<i>Cathartes aura</i>
Black vulture	<i>Coragyps atratus</i>
Crow	<i>Corvus brachyrhynchos</i>
Chimney swift	<i>Chaetura pelagica</i>
Barn swallow	<i>Hirundo rustica</i>
Yellow-shafted flicker	<i>Colaptes auratus</i>
Blue jay	<i>Cyanocitta cristata</i>
Tufted titmouse	<i>Parus bicolor</i>
Mockingbird	<i>Mimus polyglottos</i>
Brown thrasher	<i>Toxostoma rufum</i>
Robin	<i>Turdus migratorius</i>
Starling	<i>Sturnus vulgaris</i>
Eastern meadowlark	<i>Sturnella magna</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Common grackle	<i>Quiscalus quiscula</i>
Cardinal	<i>Richmondia cardinalis</i>
Indigo bunting	<i>Passerina cyanea</i>
Slate-colored junco	<i>Junco hyemalis</i>
House (English) sparrow	<i>Passer domesticus</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Chipping sparrow	<i>Spizella passerina</i>
Field sparrow	<i>Spizella pusilla</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Red-bellied woodpecker	<i>Centurus carolinus</i>
Wood thrush	<i>Hylocichla mustelina</i>
Red-eyed vireo	<i>Vireo olivaceus</i>
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>
Barn owl	<i>Tyto alba pratincola</i>
Downy woodpecker	<i>Dryobates pubescens</i>

BIRD SPECIES COMMONLY OBSERVED IN THE BUSH RIVER WATERSHED AREA (continued)

<u>Common Name</u>	<u>Scientific Name</u>
Carolina chickadee	<i>Parus carolinensis</i>
Carolina wren	<i>Thryothorus ludovicianus</i>
Pine warbler	<i>Dendroica pinus</i>
Yellow-breasted chat	<i>Icteria virens</i>
American goldfinch	<i>Spinus tristis</i>

Sources: The Breeding Bird Survey; 1966, 1967, 1968, and 1969
United States Department of the Interior, Fish and Wildlife
Service, Bureau of Sport Fisheries and Wildlife and the
Breeding Bird Survey in Virginia, 1966-1968, Willet T.
Van Velzen.

AQUATIC INSECTS COLLECTED IN BUSH RIVER WATERSHED

<u>Order</u>	<u>Family</u>	<u>Genus</u>
Coleoptera	Gyrinidae	<i>Dineutus</i>
Coleoptera	Heteroceridae	<i>Heterocercus</i>
Coleoptera	Psephenidae	<i>Psephenus</i>
Diptera	Chironominae	<i>Chironomus</i>
Diptera	Tipulidae	<i>Tipula</i>
Ephemeroptera	Baetidae	<i>Ameletus</i>
Ephemeroptera	Ephemeridae	<i>Campsursus</i>
Ephemeroptera	Ephemeridae	<i>Potamanthus</i>
Ephemeroptera	Heptageniidae	<i>Heptagenia</i>
Hemiptera	Corixidae	<i>Sigara</i>
Hemiptera	Gerridae	<i>Gerris</i>
Odonata	Agrionidae	<i>Agrion</i>
Odonata	Gomphidae	<i>Gomphus</i>
Odonata	Gomphidae	<i>Hagenius</i>
Odonata	Libellulidae	<i>Libellula</i>

OTHER FRESH WATER INVERTEBRATES COLLECTED:

Decapoda	Astacidae	<i>Cambarus</i>
Ctenobranchiata	Viriparidae	<i>Campe loma</i>
Pelecypoda	Sphaeriidae	<i>Sphaerium</i>

APPENDIX F

GLOSSARY

- Alluvium - A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediments laid down in river-beds, flood plains, lakes, fans at the foot of mountain slopes, and estuaries.
- Benefits - The value of increased output of goods and services, the value of output resulting from external economics, and nonmonetary beneficial effects on environmental and social well-being resources.
- Biota - The flora and fauna of a region.
- Branch - A stream that flows into another usually larger stream. A tributary.
- Channel Improvement - The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its capacity. Sometimes used to connote channel stabilization.
- Conservation Land Treatment Measures - Construction and management-type practices normally planned, installed, and maintained by individuals or groups of landowners on their own lands to efficiently use and protect the land and water resources. These measures serve to reduce runoff, erosion, and sediment that would restrict land use, adversely affect the environment, and reduce the realization of maximum benefits from other existing and proposed measures.
- Costs - The value of all resources required for or displaced by proposed project measures, the value of losses in output resulting from external diseconomies, and nonmonetary adverse effects on environmental and social well-being resources.
- Drainage Area - The area draining into a stream at a given point.
- Ecology - The study of the interrelationships of living organisms to one another and to their surroundings.

GLOSSARY (Continued)

- Ecosystem - Recognizable, relatively homogeneous units, including contained organisms, their environment, and all of the interactions among them.
- Emergency Spillway - A rock or vegetated earth waterway around a dam, built with its crest above the normally used principal spillway. Used to assist the principal spillway in conveying extreme amounts of runoff safely past the dam.
- Emergency Spillway Crest - The elevation at which, if exceeded, water starts flowing through the emergency spillway.
- Erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity.
- Eutrophication - The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears. During eutrophication the lake becomes so rich in nutritive compounds, especially nitrogen and phosphorus, that algae and other microscopic plant life become super-abundant, thereby "choking" the lake, and causing it eventually to dry up. Eutrophication may be accelerated by many human activities.
- Fauna - The animal life of a region.
- Fifty-year Flood - See Frequency.
- Flood - In common usage, an event where a stream overflows its normal banks.
- Flood Detention Pool - The total volume of space provided between the elevations at which discharges begin through the principal and emergency spillways, less any capacity between these two elevations reserved for sediment.
- Flood Plain - The land area bordering a river or stream which is subject to flooding.
- Flood Plain Management - Reducing potential flood losses by land treatment, nonstructural, and structural measures, or combinations thereof.

GLOSSARY (Continued)

- | | |
|--------------------------------|--|
| Floodwater Damage | - The point of beginning damage is that elevation above which floodwaters cause economic losses. |
| Floodwater Retarding Structure | - A single-purpose structure providing for temporary storage of floodwater and its controlled release. |
| Flora | - The plant life characteristic of a region. |
| Frequency | - An expression or measure of how often a hydrologic event of given size or magnitude should, on an average, be equaled or exceeded. For example, a 50-year frequency flood or 50-year flood should be equaled or exceeded in size, on the average, only once in 50 years. In drought or deficiency studies, it usually defines how many years will, on the average, be equal to or less than a given size or magnitude. |
| GM | - Silty gravels, gravel-sand-silt mixtures |
| Ground Water | - The water in a saturated zone beneath the water table. A source of base flow in streams. |
| Intermittent Stream | - A stream which flows but part of the time, as after a rainstorm, during wet weather, or only during part of the year. |
| Main Stem | - The principal stream of a watershed to which all streams tributary to it feed. |
| Mast | - Nuts (as beechnuts and acorns) accumulated on the forest floor and often serving as food for wildlife or other animals. |
| MH | - Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. |
| ML | - Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity. |
| Multiple-Purpose (Use) | - In the case of water resources, development of a particular water resource to serve two or more purposes simultaneously. |
| Natural Streams | - Those streams in an unaltered and unpolluted condition. |

GLOSSARY (Continued)

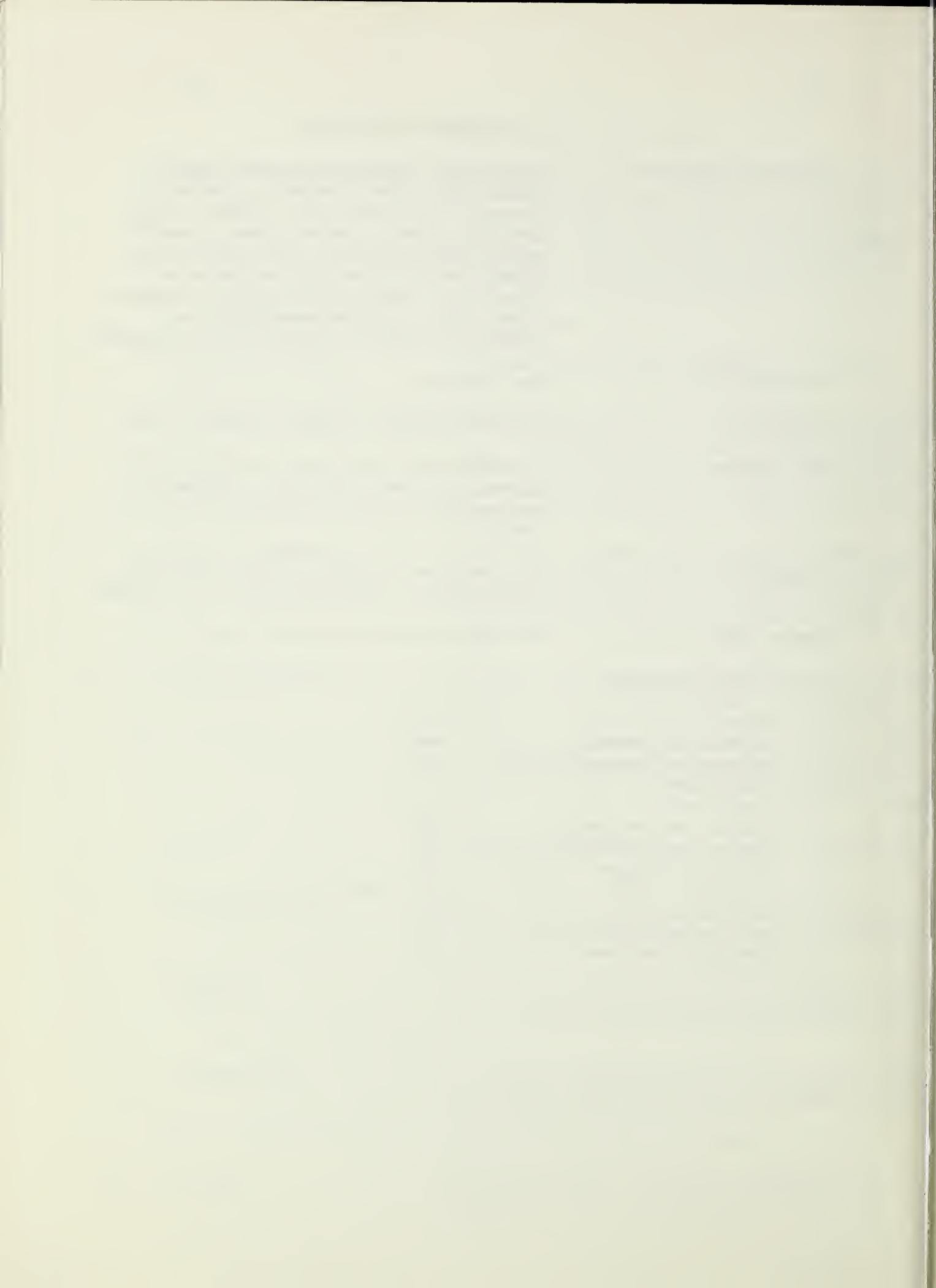
- Nonstructural Measures - Items such as flood insurance, flood warning systems, flood plain zoning or acquisition, flood proofing, relocating existing developments in flood-prone areas, building codes, and other land use controls or restrictions for achieving project objectives.
- One-hundred-Year Flood - See Frequency.
- Perennial Stream - A stream which flows throughout the year.
- Principal Spillway - A concrete or metal pipe or conduit used with a drop inlet dam or floodwater retarding structure. It conveys, in a safe and nonerosive manner, all ordinary discharges coming into a reservoir and all of an extreme amount that does not pass through the emergency spillway.
- Project Agreement - A written agreement entered into between the Soil Conservation Service and the sponsor(s) in which detailed working arrangements are established for the installation of works of improvement or other related purposes.
- Project Measures - An undertaking for watershed protection; flood prevention; the conservation, development, utilization, and disposal of water; the conservation and proper utilization of land; or a combination thereof. The undertaking may consist of land treatment, nonstructural or structural measures, or a combination thereof.
- Reach - A length of stream, selected for convenience in a study.
- Recreation Areas - Such areas as scenic, hunting and fishing, national and state forests, parks, monuments, refuges, drives, and campgrounds.
- Sediment - Soil or mineral material transported by water and deposited in streams or other bodies of water.
- Sediment Pool - Reservoir storage provided for sediment, thus prolonging the usefulness of floodwater pools.
- SM - Silty sands, sand-silt mixtures.
- Storage - The impoundment in surface reservoirs or accumulation in underground reservoirs of water for later use or release.

GLOSSARY (Continued)

- Structural Measures - Items such as dams, diversions, basins, dikes, pipe lines, conduits, channels, fences, pits, ponds, fish ladders, fish shelters, drops, checks, flumes, control gates, pumping plants, and outlet structures when the items are excavated or constructed with concrete, earth, masonry, metal, rock, or other materials, and vegetation which is a part of the structure.
- Ten-year-Flood - See Frequency
- Tributary - A stream feeding a larger stream or lake.
- User Charge - A charge made upon direct beneficiaries (users) of a water project, designed to recover part or all of the cost of the project.
- Watershed - All the area contained within a drainage divide above a specified point in a stream.
- Water Table - The upper surface of ground water.

List of abbreviations.

acre feet	ac-ft
animal unit months	aum
biochemical oxygen demand	BOD
board foot	bd ft
cubic foot	cu ft
cubic feet per second	cfs
cubic feet/second/square mile	csm
dissolved oxygen	DO
milligrams/liter	mg/l (ppm)
milliliter	ml
million gallons per day	mgd
parts per million	ppm



APPENDIX G

BUSH RIVER WATER QUALITY DATA 1/

SAMPLES TAKEN MAY 16, 1974

State Code	Parameter	Sample Numbers									
		12743	12739	12738	12742	12741	12740	12744	12737		
055	Coliform, Fecal/100 ml	200	100-	500	200	200	100-	200	100		
050	pH (Laboratory)	7.0	7.0	7.1	7.0	7.1	7.0	7.1	7.1		
022	Alkalinity mg/l as CaCO ₃	29	32	48	33	41	36	42	31		
024	Total Solids, Total mg/l	94	84	187	79	108	109	111	89		
025	Volatile mg/l	23	20	40	23	32	14	12	21		
026	Fixed mg/l	71	64	147	56	76	95	99	68		
027	Suspended Solids, Total mg/l	6	5	83	7	5	27	4	6		
028	Volatile mg/l	2	2	12	2	3	5	3	3		
029	Fixed mg/l	4	3	71	5	2	22	1	3		
033	Chloride mg/l	2	3	4	3	3	6	2	4		
035	Nitrogen, Total Kjeldahl	0.5	0.2	0.3	0.2	0.2	0.2	0.4	0.1-		
065	Phosphorus, Total mg/l as P	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-		
064	Phosphorus, Ortho mg/l as P	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-		
036	Ammonia mg/l as N	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-		
037	Nitrite mg/l as N	0.01-	0.01-	0.01-	0.01-	0.01-	0.01-	0.01-	0.01-		
038	Nitrate mg/l as N	0.03	0.03	0.11	0.03	0.01-	0.01-	0.01	0.13		
019	BOD ₅ mg/l	1	1	1	1	1	1	1	1		
051	COD mg/l	8	12	8	8	4	12	4	16		
	Dissolved Oxygen (mg/l)	7.8	8.2	7.9	8.4	7.0	8.0	7.4	8.0		
	Temperature (Fahrenheit)	66°	65°	67°	66°	64°	68°	66°	67°		

12743 Site #1E Rt. 15 bridge (Briery Creek)
 12739 Site #2 Rt. 647 bridge (Rice Creek)
 12738 Site #3 1/4 mile up to confluence of Cunninghams Creek and Bush River (Cunninghams Creek)
 12742 Site #4B Rt. 628 bridge (Mountain Creek)
 12741 Site #5 Station just off fire trail (Camp Creek)
 12740 Site #6 Rt. 632 bridge (Evans Creek)
 12744 Site #7 Rt. 633 bridge (Bush River)
 12737 Site #12 Rt. 460 bridge (Sandy River)

1/ Bureau of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.



BUSH RIVER WATER QUALITY DATA 1/

State Code	Parameter	Sample Numbers for station 11.01									
		Sandy River, Prince Edward State Park at Dam									
		5197	5613	7478	7863	8914	10807	11538	12842	15762	17996
055	Coliform, Fecal/100 ml	100-	100-	100-	100-	100-	100-	100-	100-	100-	300
	Field pH	7.5	6.7	7.4	6.2	7.5	7.8	7.3	6.8	7.5	7.2
	Dissolved Oxygen (mg/l)	8.4	8.2	8.0	6.8	11.8	7.8	8.6	8.4	NR	6.2
	Temperature (Fahrenheit)	76°	84°	78°	90°	81°	85°	76°	60°	80°	80°
	Date sample taken	5/72	6/72	7/72	7/72	8/72	8/72	9/72	10/72	5/73	6/73

State Code	Parameter	Sample Numbers for station 11.11									
		Sandy River, Prince Edward State Park at Recreational Area									
		5198	5614	7479	7861	8912	10806	11537	12841	15763	17993
055	Coliform, Fecal/100 ml	100-	100-	100-	100-	100-	100-	100-	100-	100-	100-
	Field pH	7.5	6.7	7.4	6.7	7.2	7.5	7.3	6.8	7.5	8.1
	Dissolved Oxygen (mg/l)	9.6	9.6	8.2	6.0	9.6	8.2	8.6	8.6	9.0	9.2
	Temperature (Fahrenheit)	72°	84°	78°	90°	72°	84°	76°	60°	69°	81°
	Date sample taken	5/72	6/72	7/72	7/72	8/72	8/72	9/72	10/72	5/73	6/73

1/ Bureau of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.

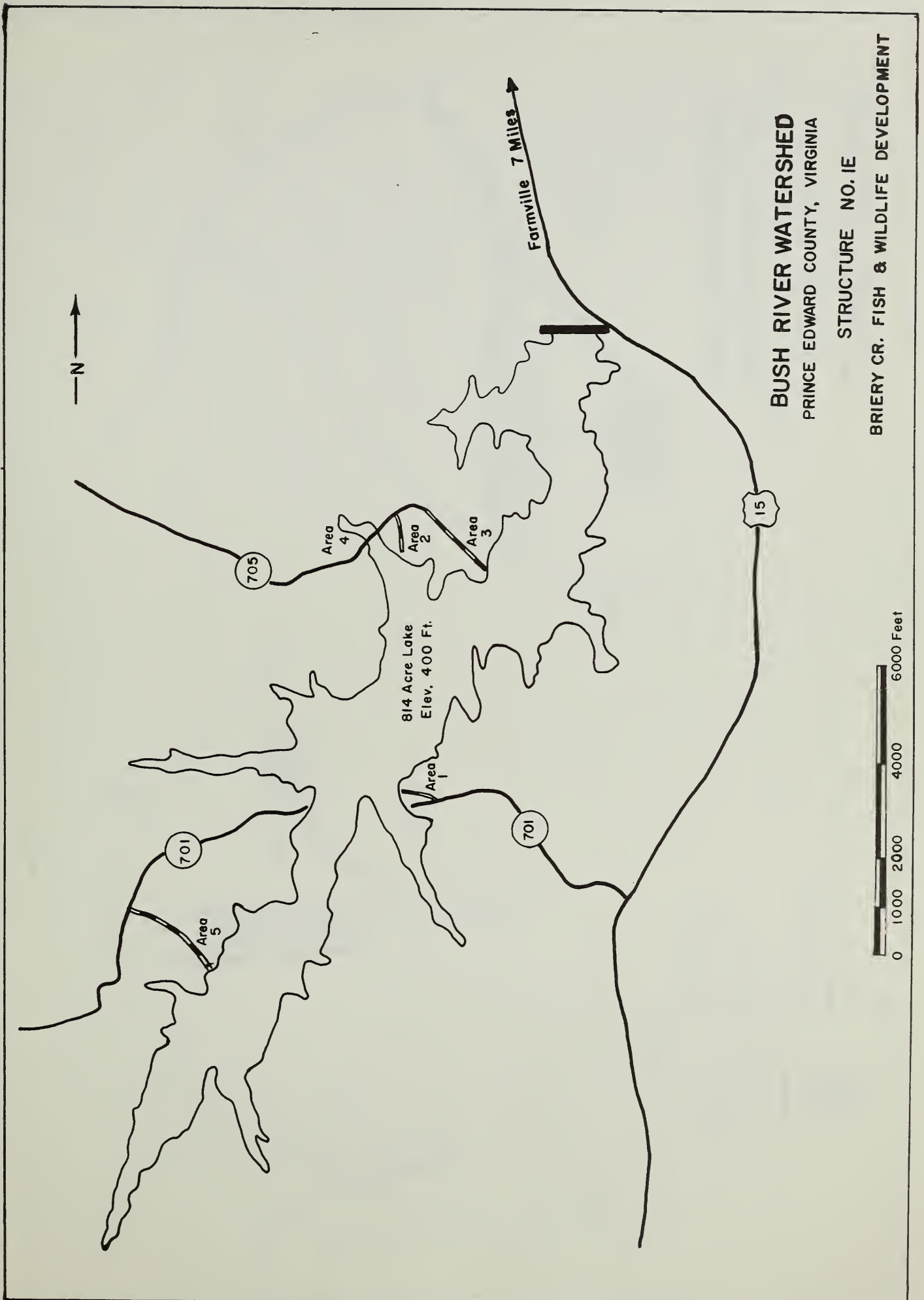
BUSH RIVER WATER QUALITY DATA 1/

State Code	Parameter	Sample Numbers for station 11.59									
		Sandy River, Prince Edward State Park Headwaters									
		5200	5615	7480	7862	8913	10808	11539	12843	15764	17994
055	Coliform, Fecal/100 ml	100-	100-	100-	100-	100-	NR	100-	100-	700	100-
	Field pH	9.0	8.5	7.4	8.4	8.0	7.5	7.3	6.8	7.5	8.6
	Dissolved Oxygen (mg/l)	13.4	8.0	8.0	7.8	8.6	9.4	8.6	9.2	7.4	9.6
	Temperature (Fahrenheit)	74°	86°	78°	84°	82°	86°	76°	60°	62°	82°
	Date sample taken	5/72	6/72	7/72	7/72	8/72	9/72	9/72	10/72	5/73	6/73

State Code	Parameter	Sample Numbers for station 0.40									
		Unnamed Tributary to Sandy River, Goodwin State Park - Recreation Area									
		5196	5616	7481	7864	8911	10805	11540	12844	15765	17995
055	Coliform, Fecal/100 ml	100-	100-	100-	100-	100-	100-	100-	100-	100-	200
	Field pH	6.6	7.0	7.0	6.9	7.0	7.5	7.3	6.8	7.6	7.4
	Dissolved Oxygen (mg/l)	8.2	8.4	7.2	7.6	9.6	8.0	9.0	8.0	9.0	7.0
	Temperature (Fahrenheit)	76°	84°	78°	90°	81°	84°	76°	60°	69°	82°
	Date sample taken	5/72	6/72	7/72	7/72	8/72	8/72	9/72	10/72	5/73	6/73

1/ Bureau of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.

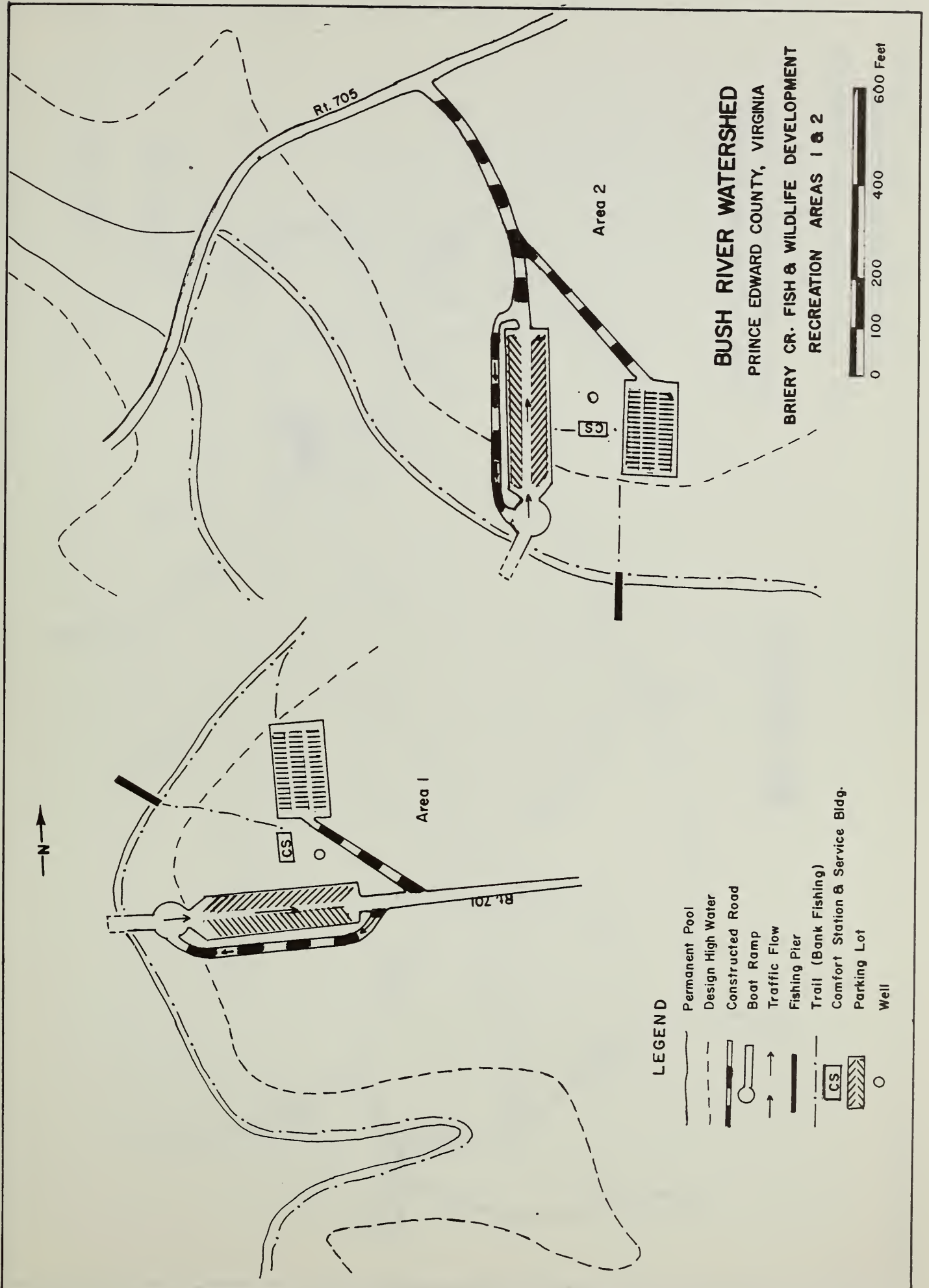
LOCATION OF WATER QUALITY SAMPLES IN BUSH RIVER WATERSHED



BUSH RIVER WATERSHED
PRINCE EDWARD COUNTY, VIRGINIA

STRUCTURE NO. IE

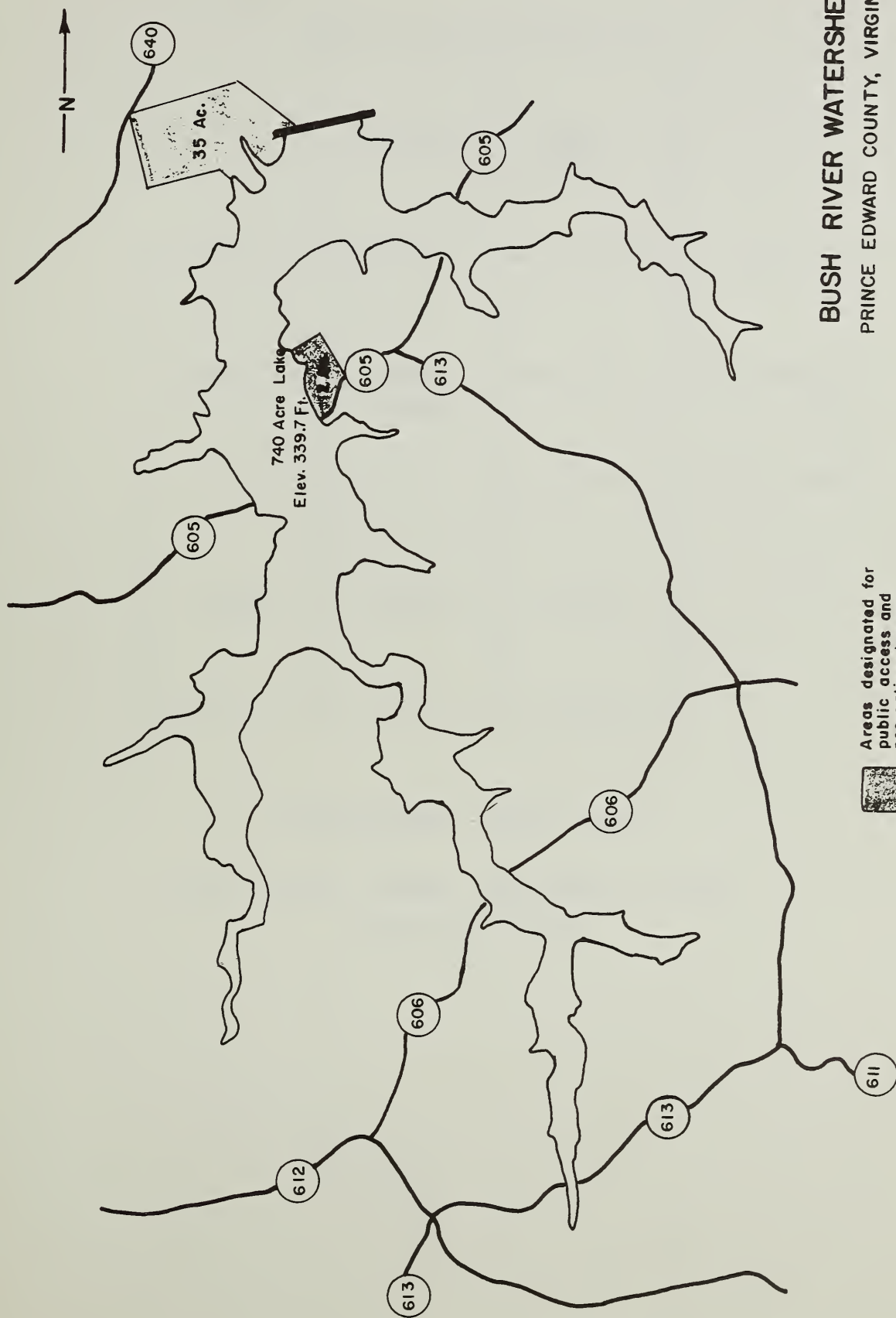
BRIERY CR. FISH & WILDLIFE DEVELOPMENT



LEGEND

- Permanent Pool
- Design High Water
- Constructed Road
- Boat Ramp
- Traffic Flow
- Fishing Pier
- Trail (Bank Fishing)
- Comfort Station & Service Bldg.
- Parking Lot
- Well

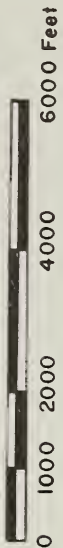


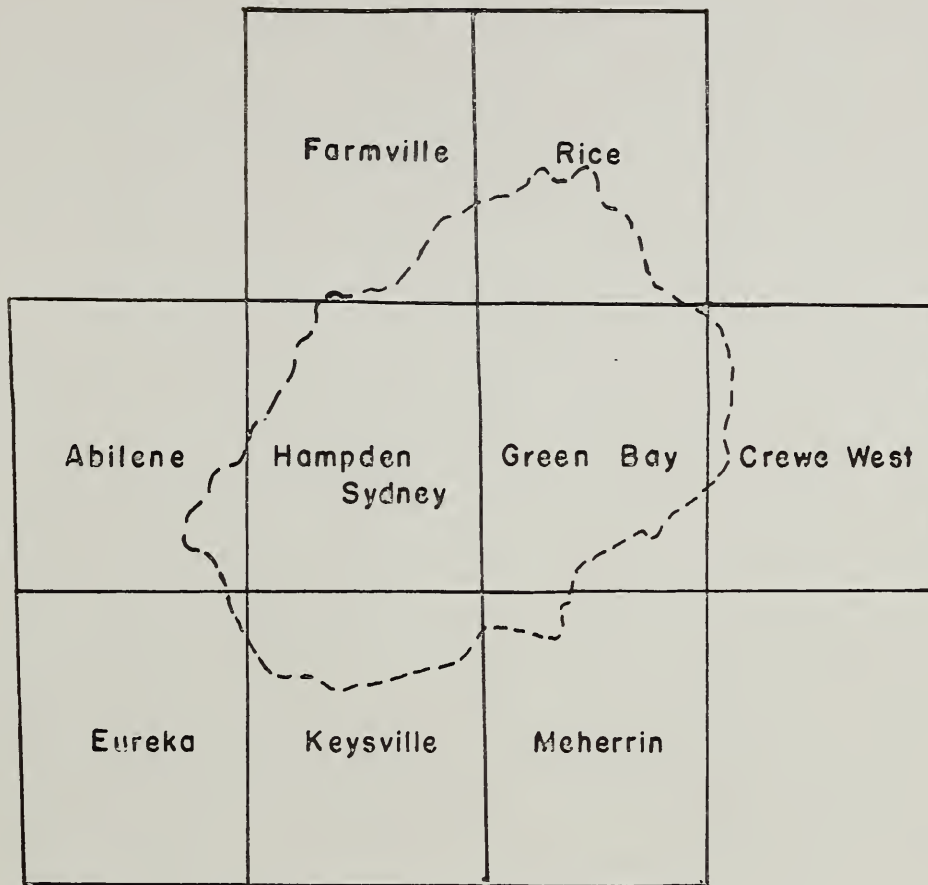


BUSH RIVER WATERSHED
PRINCE EDWARD COUNTY, VIRGINIA
STRUCTURE NO.12

SANDY RIVER WATER SUPPLY RESERVOIR

Areas designated for
public access and
recreational use.





Topographic Map Index

From United States Geological Survey
7 1/2 min. Series

